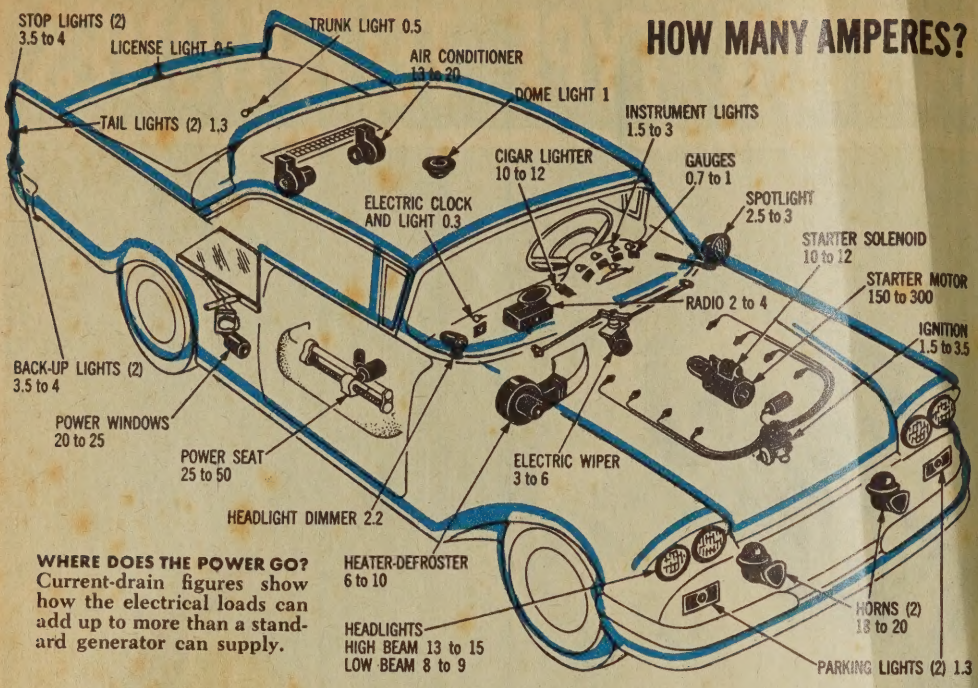
USH-BUTTON TYPE TELEPHONES

on the basis of many months of "human factor" study, this push-button type phone is said to give greater in dialling than the conventional method. This and other advances are made feasible by various electronic nts, including the transistor. Authorities say it is only a matter of time—and money —before subscribers available loudspeaking telephones, "television" systems, automatic transcription from teletype to words, and " phones. These latter will be styled and worn like a wrist-watch and will operate into the wired system the need for connecting leads. The telephone above has been developed by Bell Laboratories.


HOW MANY AMPERES?
STOP LIGHTS (2) 3.5 to 4
LICENSE LIGHT 0.5
TRUNK LIGHT 0.5
AIR CONDITIONER 13 to 20
DOME LIGHT 1
TAIL LIGHTS (2) 1.3
INSTRUMENT LIGHTS 1.5 to 3
CIGAR LIGHTER 10 to 12
GAUGES 0.7 to 1
ELECTRIC CLOCK AND LIGHT 0.3
SPOTLIGHT 2.5 to 3
STARTER SOLENOID 10 to 12
STARTER MOTOR 150 to 300
RADIO 2 to 4
IGNITION 1.5 to 3.5
BACK-UP LIGHTS (2) 3.5 to 4
POWER WINDOWS 20 to 25
POWER SEAT 25 to 50
ELECTRIC WIPER 3 to 6
HEADLIGHT DIMMER 2.2
HEATER-DEFROSTER 6 to 10
HEADLIGHTS HIGH BEAM 13 to 15 LOW BEAM 8 to 9
HORNS (2) 18 to 20
PARKING LIGHTS (2) 1.3

WHERE DOES THE POWER GO? Current-drain figures show how the electrical loads can add up to more than a standard generator can supply.

Modern Cars Are Running Out of Amps!

Over the years, motor car designers have steadily increased the load on the battery and generator, as well as the requirements of the ignition system. In the more elaborate cars, at least, they have just about reached the limit of present techniques and are searching for new methods.

CHANCES are that the last auto-repair bill you paid was for work on your car's electrical system.

Many drivers of recent cars are resigned to buying frequent ignition tune-ups to keep their engines running right. Garage operators report that the most frequent calls for emergency service (aside from out-of-gas) are for electrical troubles.

But things are going to get better. Research that started in the telephone field has given the auto engineers hardware that promises to whip these problems. It all started with Bell Labs' work with semiconductors.

BIG CHANGES

You'll soon be seeing revolutionary changes rather than evolutionary ones. AC generators and transistor regulators —available now as extra-cost equipment —will replace the present units.

In the offing are several new kinds of ignition systems, including dramatic new replacements for the ancient spark plug.

The margin of reserve power in the crucial parts of your car's electric system has been shrinking. This has come in spite of steady improvements:

- Maximum output of conventional generators is up from 85 watts in 1925 to over 600 watts on some cars this year.
- Battery capacity has more than tripled with little increase in package size.
- Spark voltage available is up to about 25,000 volts (at 50 m.p.h.) compared with 12,000 volts in 1925.

These have resulted from modifying a system that, fundamentally, has not changed since Boss Kettering put electric starters on the 1912 Cadillac.

Engineers have found it increasingly difficult to meet the rising needs of each new model, within the limitations of the traditional system.

As a result they have had to nibble away at that margin of reserve that would allow a comfortable leeway for moderately careless maintenance, or unusual use. Here the s tion:

● St ard gener tors not carry typica oad in slo traffic where yo do m nd more your ng.

● Ca are loade with r - hungr access that drai curren even whe idling affic — an more coming.

● Bat s mu s make deficit fo long ches ar still b to sta the b r engine Even subseque fast dr g recharg a batte such "de cycling" rastica l l shortens life.

● Ignit syste m have to ork mu harder high-co pression gines, a the sma margin reserve eans f quent tu ps to ke one runn g right.

Why ? So f no one s found better w to packa enough power crank the ngine th the stor batte So you s need l to charge e batte Why sw to generator

The po r you get from given s of DC erator limited by he amo of curren that pass thro h the s ing cont of brushes thout cessive spark Commuta n is snag.

But a C gen tor is ess tially AC genera r with commu tor brush rigging acting as a ary re fier. You can skirt the problem generating AC and using sepa static rectifier to get the requ d DC

There are a couple of add ben from this arrangement:

(1) The AC generator can e a th phase machine which gives 1 times much power for he same mount active materials.

INSIDE-OUT

(2) You can turn the gener or ins out so that the heav currents re ge ated in the stationary windin s. Th a rotating-field gener tor. No the current passing through slidin con is the small current eeded to make rotor an electromagn.

What are we waiting for? The bige stumbling block has een the ack suitable rectifier. Selenium rectifiers used in the AC syste s that have available in limited umbers. But are bulky, expensive nd can't ake temperatures. And sel nium is relati scarce.

Research in semiconductors, spac by the fantastic success of transistors h produced the silicon ode rectifier. is extremely compact, withstands hig

by Hubert Lucket

temperatures, will handle heavy currents, and is made of one of the world's most plentiful materials.

Although the present price is high, experts are sure the cost can be drastically reduced with quantity production.

You can get them now. Delco-Remy recently brought out an AC generator specifically designed for passenger cars. It has silicon rectifiers built into the generator housing. It is only 5¾ inches in diameter and fits the same mounting as the standard 12-volt, 30-ampere generator.

Its maximum output is 60 amps and it will deliver 26 amps at idle. Although it is available now only as an aftermarket accessory, insiders are betting it will show up on some production cars within the next year or two.

One of the most troublesome items on a car is eliminated by a companion unit, an all-electronic regulator using transistors.

STANDARD ON TRUCKS

Ford has already announced that similar equipment, built by Leece-Neville Company, will be standard on several lines of trucks.

How you benefit. Not every car owner will need the extra capacity of the alternator systems, but if your electrical requirements are severe, if you have to recharge or replace your battery frequently, here's what this new system can do for you:

- It will deliver enough electricity at idle to operate all the accessories on most cars with no help from the battery.
- Battery life is prolonged. With the battery always fully charged, "deep cycling" is eliminated. Experts say that this is the principal reason why batteries wear out.
- With the transistor regulator, this source of trouble is practically eliminated.
- System voltage can be regulated at lower maximum voltage and still keep the battery charged. This means longer life for your lights, radio tubes and other voltage-sensitive parts.
- It's predicted that no service on the alternator will be required for the average first-owner life of the car. The unit has an estimated life of 100,000 to 300,000 miles.

ENOUGH SPARK?

Do you run out of spark? The standard, battery-ignition system has dominated the industry for over 30 years because it is simple, reliable and inexpensive. When more spark-energy output was needed, you simply put more energy into the system—when you have a bigger nail to drive, you get a bigger hammer.

But, just as you finally reach a limit in the size of hammer you can handle, the simple battery-ignition system has just about reached the limit of the input power it can handle.

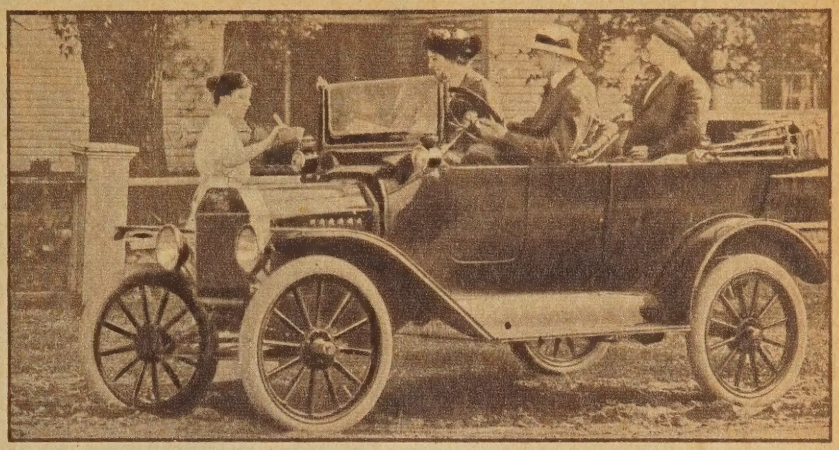
The breaker points are the bottleneck. They interrupt the current in the primary of the ignition coil some 12,000 times for every mile you drive.

As the contacts separate, all the current tends to squeeze through the last microscopic area of contact and you get current densities in excess of a million amperes per square inch.

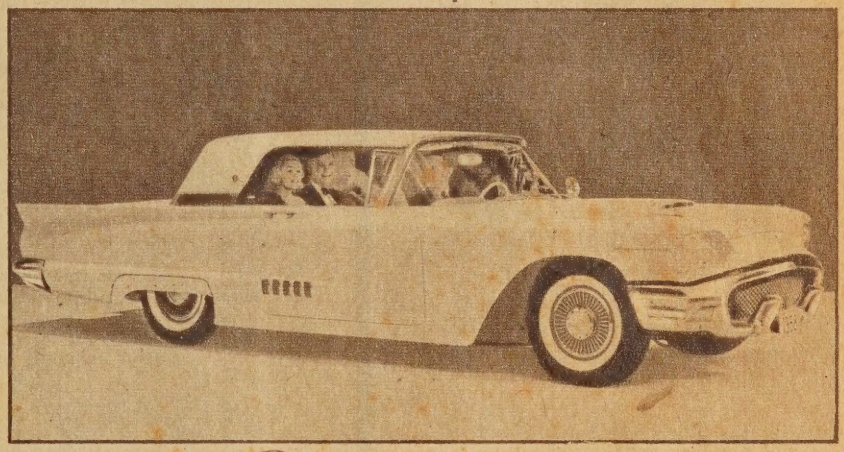
This generates enough heat to melt the tungsten (6,100 degrees Fahrenheit).

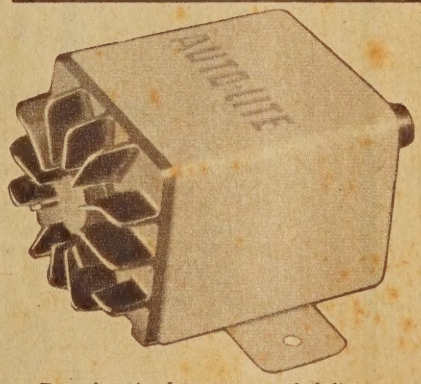
Pull apart a melted cheese sandwich, and you have a fairly good idea of what happens as the contact surfaces separate.

HOW DIFFERENT — YET THE SAME!



Modern cars like the Ford "Thunderbird" (below) carry so many more electrical gadgets than their predecessors (above) that they have just about reached the limit of "conventional" auto electrical development. New approaches are necessary.





Transistorised ignition coil delivers high spark voltage at all engine speeds, and ends major causes for breaker-point replacement.

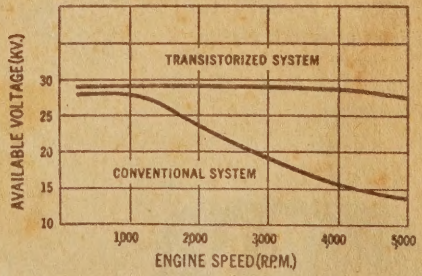
Engineers call it "bridging." Some of the metal is pulled out of one surface, actually prolonging the electrical current beyond the point where it should be interrupted.

At the final break, some of the metal vaporises and some is deposited on the other contact surface. Even after the contacts separate, current tends to keep flowing across the air space and you may get some arcing that adds to the electrical erosion of the contacts.

Not only are the contacts destroyed when this cycle is repeated often enough, but the erratic nature of the bridging and arcing causes slight inaccuracies in the timing of the spark. These timing inaccuracies contribute to engine roughness.

Blue points. There is another exasperating effect that happens sometimes in cold weather. At low temperatures the resistance in the primary circuit is lower, and the starter turns the engine more slowly.

Lower resistance means a heavier current in the coil, and slower operation of the breaker points causes them to carry this current for a longer time. The entire contact button gets hot enough for the surface of the tungsten to oxidise, forming an insulating coat of blue tung-



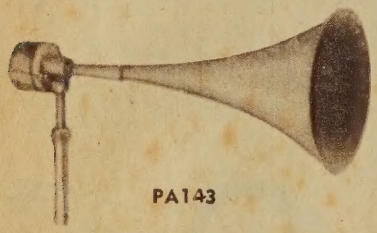
Conventional VS transistor: Graph shows high voltage output of new transistor system, across full range of engine speed, compared with that of a conventional system in peak condition.

Sound Distribution SPEAKERS

AWA manufacture the most complete range of speaker assemblies—there's a unit for every sound reinforcement need. AWA designs these speakers for maximum faithfulness in sound reproduction. Styles and finishes are available from stock or designed for individual use and circumstance.

PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.



PA143

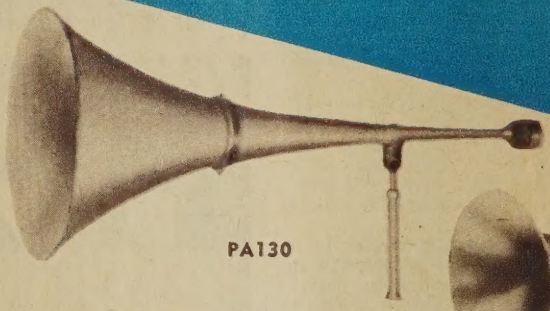
Short exponential horn speaker for distance projection of speech only.

Ivory timber cabinet with 7in speaker for applications where a bidirectional characteristic is desired.

PA73

RESLO DRIVE UNITS
SU10 & SU12

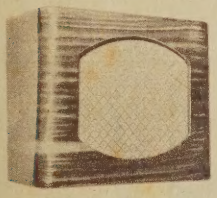
Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly proof against decentering.



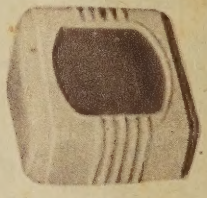
PA130

PA108 & PA109

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.
These flare baffles are for use with 7in and 12in permanent magnet cone speaker units and provide high conversion efficiency.



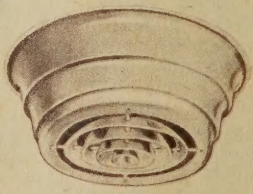
PA77/12PS
Polished timber cabinet for wall or table mounting with 12in cone speaker and 600 ohm line transformer.



PA150/1
Attractive moulded cabinet with 7in cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting. In grey, ivory and walnut.

PA343
General purpose line source reproducer for music and speech range 100 to 7,000 cycles. Power capability 15 watts of programme.

PA218
Designed for overhead mounting in contemporary styling. The unit can be suspended by chain or rod. Gives uniform response over a wide area.



PA188
For overhead mounting this is a surface style unit. 360-degree diffusion over a wide area. In smart styling to suit modern architectural treatments.

PA186
For flush mounting this unit has a recessed acoustic surround which mounts the complete assembly above the ceiling line. 360-degree diffusion.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED
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167 Queen Street, Melbourne. MU9161.
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Newton McLaren Ltd., Adelaide. ● Chandlers Pty. Ltd., Brisbane.
Also from leading wholesalers.

sten oxide. When this happens, your car won't start.

Dilemma. All of these troubles—melting, bridging, arcing and bluing — get worse as the primary current is increased. But with conventional systems, there are only two ways you can get more energy into the system to take care of increasing spark voltage output requirements; either increase the primary current or increase the primary voltage.

The voltage is fixed by your car's battery voltage, and, as you can readily guess from the above, any further increase in current would probably mean installing new points every time you filled your gas tank.

The switch to 12-volt batteries eased the problem for a while. But there are reasons why another step-up in battery voltage is undesirable.

Fast action. At 60 miles an hour, the rate of point operation is something like 200 times a second. If you step down on the accelerator to pass, driving at this speed, you may find that your engine doesn't respond, if you have failed to have a tune-up fairly recently.

Here's what happens:

When the contact points are closed, energy is stored up in the coil in the form of a magnetic field. When the points open, this magnetic field suddenly collapses, inducing a high voltage in the coil's secondary winding, which fires the spark plug.

If the points don't stay closed long enough to build the magnetic field to a maximum, then there will be less voltage available to fire the plug.

To make matters worse, you need a higher voltage to jump the spark-plug gap when you are accelerating. Just at the time you need more spark voltage, there is less available to do the job.

TRANSISTORS

Transistors to the rescue. There have been dozens of different ignition systems under development in the last year or two. Magnetos and dual-breaker systems have long been used by the hot-rodders and racing cars. Dual points have even shown up on some production cars. But most of the alternative systems have been either too expensive, to complicated, or gave too little improvement for the cost.

The Electric Auto-Lite Company has introduced an ignition package which, they claim, will not only lift the ceiling placed on engine design by conventional ignition, but will give owners of today's cars the means of enormously improving the reliability of their ignition systems.

The key to its operation is a transistor. It is a single-package unit only slightly larger than the ignition coil it replaces.

In demonstrations, the manufacturer has shown that this unit will:

- Deliver a constant high voltage of around 30,000 volts throughout the speed range of an engine.
- Give practically unlimited contact life.
- Eliminate engine roughness due to minor variations in timing caused by excessive arcing and bridging.
- End cold-weather starting problems due to contact-point oxidation (blue points).

The packaged unit consists of a specially designed high-voltage transformer, a power transistor, its heat sink and associated circuitry.

In operation the system is similar to conventional systems, except that the brunt of the task of interrupting the heavy primary current is taken over by the transistor. It can handle primary currents of eight amps with no problem of bridging and arcing.

The transistor is triggered by, and engine timing is still controlled by, the mechanical contacts. But now they interrupt only a quarter of an amp.

With plenty of spark energy available, it will be possible to engineer ignition systems that will be practically immune to spark-plug fouling. These advanced systems should not be confused with the various "gimmick" spark plugs sold by quick-buck promoters.

One proposed system, already being made for military vehicles, uses spark plugs in which the spark takes place along the surface of a semiconductor. It actually works better with an accumulation of deposits than it does when clean.

SERIES GAP

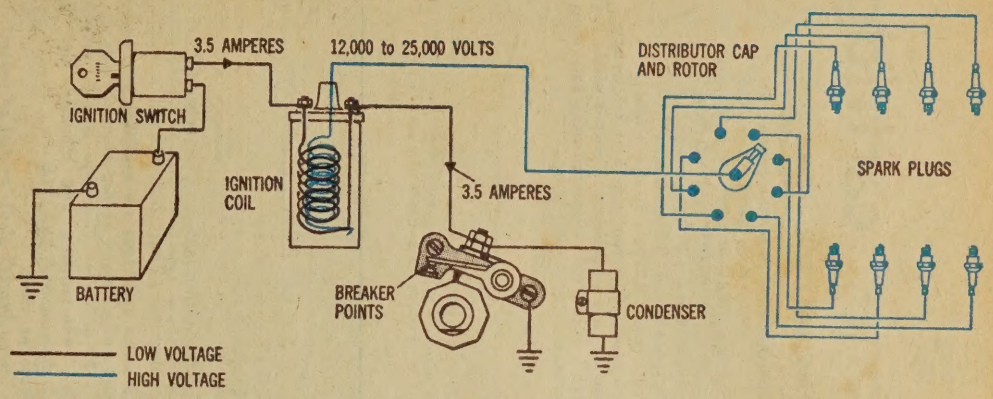
Plugs with a series gap are a more likely prospect for passenger cars. A second gap, ahead of the one at the business end of the plug, keeps the high voltage from leaking to ground through the partially conductive deposits on the insulator nose.

When the voltage builds up enough to jump the series gap, it jumps the gap in the combustion chamber simultaneously. It happens so suddenly that there is no time for leakage to ground.

The AC generator, transistor regulator, and transistorised ignition coil are all in production. They're not just someone's dream for a car of the future. As yet, they are a bit on the expensive side, but quantity production will bring the prices down.

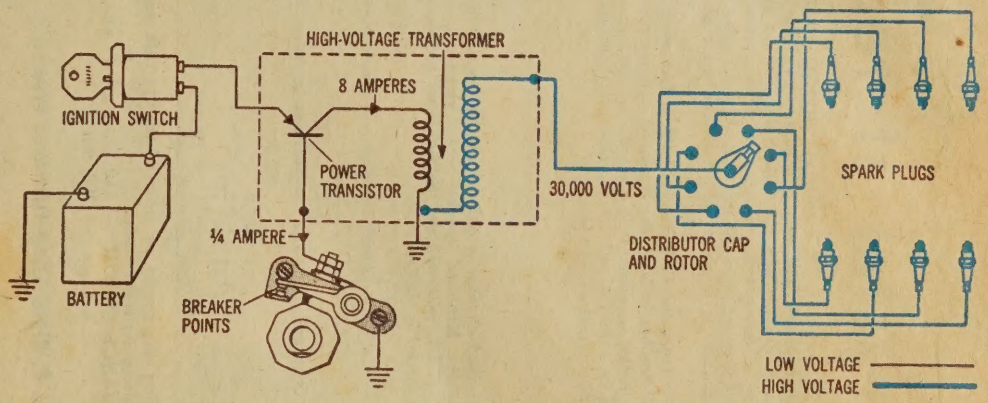
HOW TRANSISTOR SAVES BREAKER POINTS

CONVENTIONAL SYSTEM

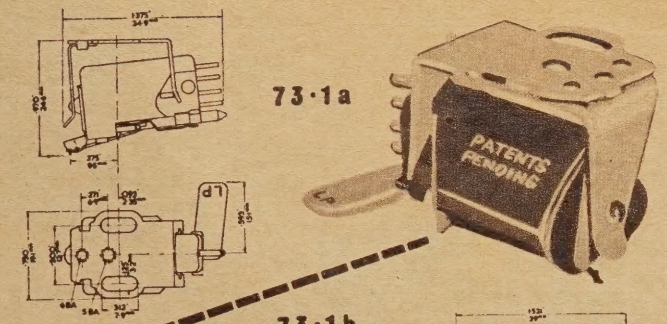


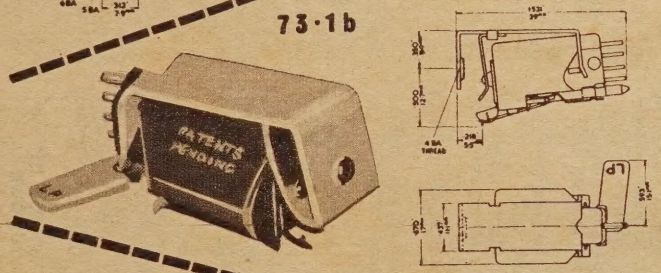
High-voltage energy available for spark is limited by the amount of primary current a car's breaker points can interrupt successfully and by the fact that, at high r.p.m., the points cannot remain closed long enough for maximum energy to build up in the ignition coil.

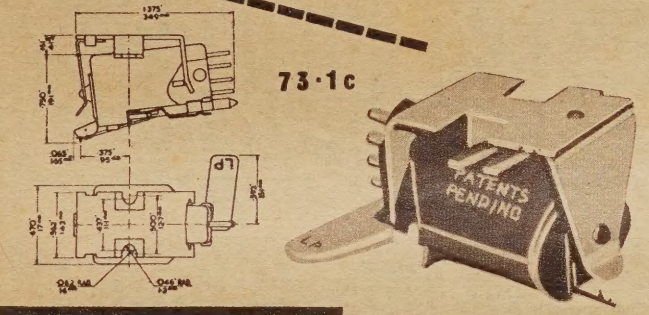
TRANSISTORIZED SYSTEM

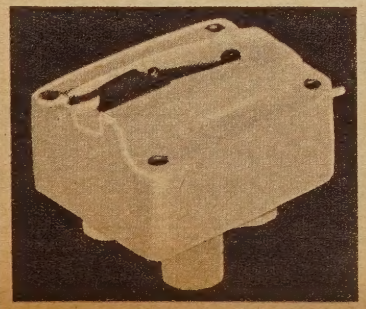


A power transistor easily interrupts up to three times the usual primary current. The mechanical contacts only trigger the transistor. This permits the design of an ignition coil that speeds energy build-up to give uniformly higher spark voltage at all engine speeds.







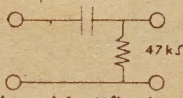


acos

Crystal stereophonic cartridge

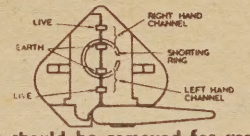
The "ACOStereo" 73-1 is a universal cartridge designed to play stereophonic and monophonic discs, including 78 r.p.m. coarse groove records. Three brackets are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC. 110 and RC. 120 changers, and the "c" bracket is intended for American arms of the VM type.

The output from the "ACOStereo" 73 is flat when fed into a 2Megohm impedance. If record compensation is available in the amplifier, it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:—



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience, and is recorded on the left-hand groove wall when the record is viewed as:—

The "ACOStereo" cartridge connections as seen from the rear:—

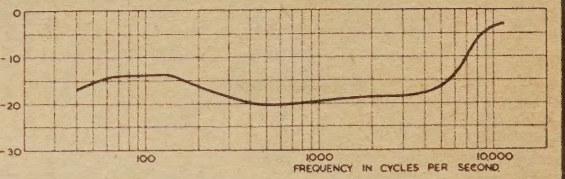


The shorting ring should be removed for use with amplifiers requiring separate leads.

PERFORMANCE OUTPUT — 160 m.v. at 1 cm/sec.
Average — 300 mv.

FREQUENCY RESPONSE—
40—12,000 c/s.
SEPARATION between channels at
1 K/cs better than 20dB.
Radii of Stylus tips—0.0005" (13.5 microns).
0.0025" (62 microns).
Recommended load: 2 Megohm.
(Compliance equals 3.5 ucm/dyne).
(Stiffness equals 0.0286 x 10 dynes/MM).
Recommended downward pressure: 3-4 Grammes.
The Stereo recording characteristics is within ½dB of the RIAA/BS 1928/1955 characteristics, and cross talk is better than — 20db at 1 K/cs.

Frequency response on PS.131.

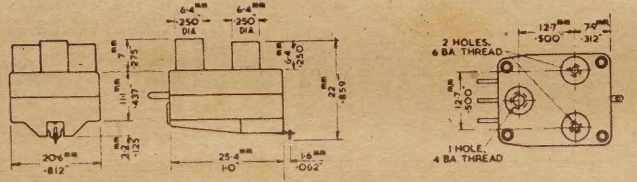


Separation between Channels on PS.131.

The response of both channels will be within 3dB.

All 73 series cartridges are available with two sapphire, sapphire and diamond or two diamond styli.
Prices: 73 series — Cartridge incl. 2 sapphire styli, £5/15/-, with sapphire and diamond styli £11/18/6, with 2 diamond styli £15/19/6.
Available ex stock.
"How Stereo Works" gladly posted on request.

71-3 For stereophonic and L. P. discs (non-turnover type).



With Sapphire stylus—Price £4/9/6
With Diamond stylus—Price £10/17/6

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U.S. DIAMOND SECRETS REVEALED

The General Electric Research Laboratory has just revealed the details of one of its major scientific and engineering achievements, the proces for making diamonds. Man-made diamonds, the climax of a 125-year effort to duplicate nature's hardest and most glamorous substance, were first announced by the Laboratory in 1955.

OF the proper size for many industrial uses — less than a 10th of a carat — these diamonds have been manufactured at General Electric's Metallurgical Products Department in Detroit, and have been sold in commercial quantities since October, 1957. Until recently the unique process has been covered by a U.S. Government secrecy order.

The United States uses more than two tons of diamonds for cutting, grinding, and polishing each year, and there are no important domestic sources of natural diamonds. With the large-scale production of man-made diamonds achieved by the company, the secrecy restrictions have been removed.

MOLTEN METAL

The essential breakthrough that enabled scientists to transform carbon into diamonds was the use of a molten metal catalyst which acted as a thin film between the carbon and the growing diamond crystal. According to Dr Guy Suits, G.E. vice-president and director of research, the molten catalytic film and the development of new superpressure and high-temperature apparatus made possible the long-sought transformation from carbon to diamond.

Without the catalytic action, it is estimated that pressures of three million pounds per square inch and temperatures of over 7,000 deg. F would be required to transform carbon into diamond. There is no equipment in existence that could produce such a combination of sustained pressure and temperature.

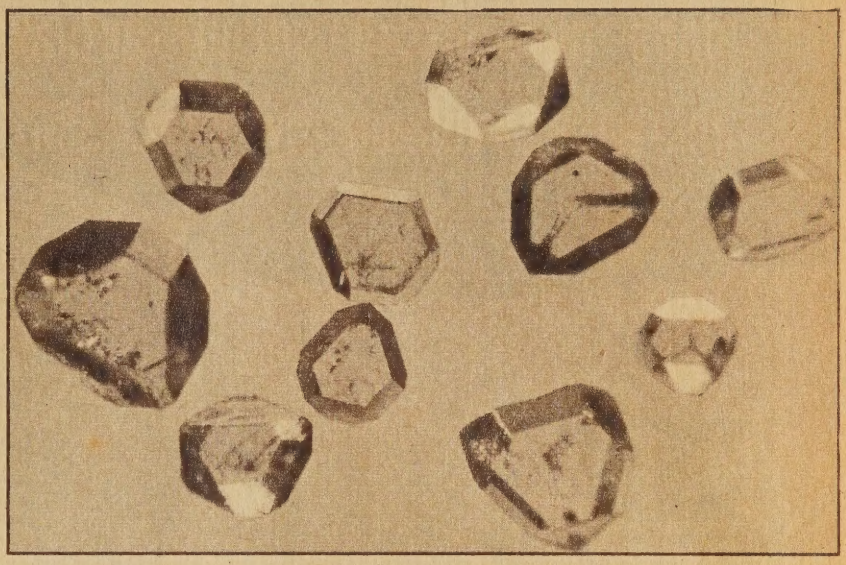
Geological evidence has long suggested that natural diamonds were formed when carbon underwent extremely high temperatures and pressure deep within the earth. But the details of this rare process were unknown.

PRESSURE CHAMBERS

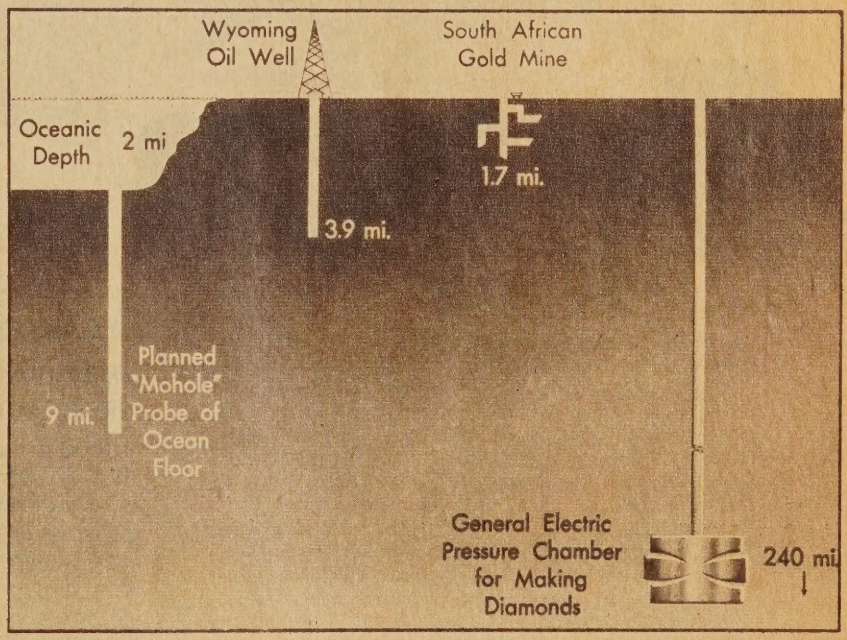
For four years a group of scientists in the Chemistry Research Department of the General Electric Research Laboratory, under the direction of Dr A. L. Marshall and A. J. Nerad, investigated many combinations of materials, pressure, temperatures, process times, and catalysts.

They also constructed various pressure chambers that extended the capacity of high-pressure and high-temperature apparatus. Finally, a system for making diamonds was evolved.

In this system carbon and a catalyst metal are placed in a pressure cell and are subjected simultaneously to pressures ranging from 800,000 to 1,800,000 pounds per square inch and temperatures ranging from 2,200 deg. F to 4,400 deg. F.



Photomicrograph of diamonds made in the General Electric Research Laboratory.



Pressures as high as 1,800,000 pounds per square inch are achieved in the pressure chamber for making diamonds. Such pressures occur in nature at a depth of 240 miles below the earth's surface.

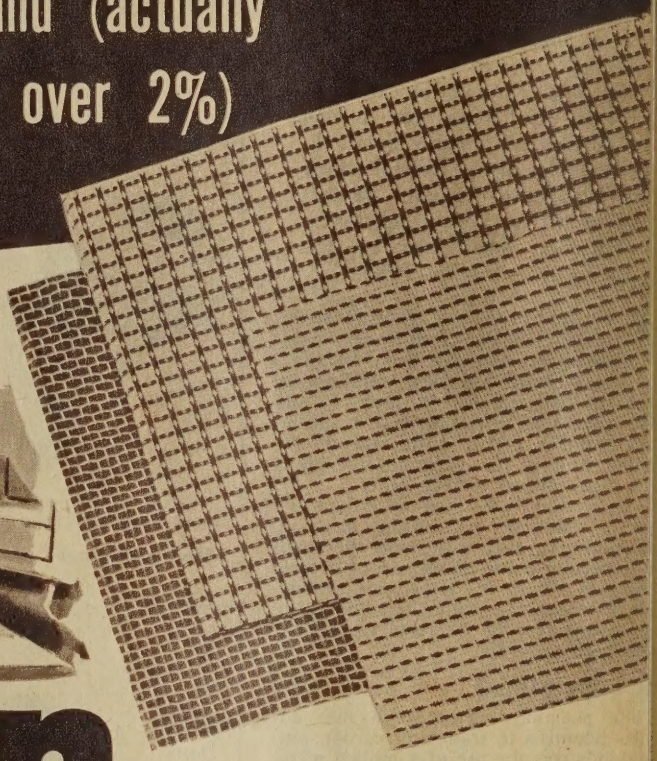
The nature of the starting material used to supply the carbon has some effect on the kind and number of the diamonds formed. The best results are obtained with substantially pure graphite. Other carbonaceous material, such as carbon black, sugar charcoal, or carburising compound, may be used as the source of carbon.

The catalyst metal can be chromium, manganese, iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, or platinum. Tantalum is particularly effective for inducing the growth of small diamond crystals, although under some circumstances it may not be as active as the other catalysts.

The scientists also discovered that new diamond can form whether diamond seed crystals are present or not, and that the diamond can grow at very high rates. The formation of man-made industrial diamonds (80 mesh and finer) is completed within a few minutes.

Progress in the industrial applications

At last! A beautiful speaker fabric that does not absorb sound (actually increases volume by over 2%)



Tygan High-Fi Fabric

Available in literally hundreds of colours, designs and weaves, Tygan High-Fi Fabric can make *your* set more beautiful. *Tygan is the most efficient speaker fabric ever.* Independent laboratory tests on the sound absorption characteristics of a variety of fabrics and fibres were recently conducted in the U.S. In reporting the results of these tests "American Fabrics" said that when an ordinary fabric was placed over the speaker the volume was reduced and the fidelity impaired. When Tygan High-Fi Fabric was placed over the speaker, an increase in the volume of up to 2% was noted. This is because Tygan does not absorb sound and even reflects some back into the speaker.

It's so easy to put a beautiful Tygan Fabric onto your set—it only takes about thirty minutes work.

IMPROVED FIDELITY IN HIGH-FREQUENCY RANGE UP TO 14,000 CYCLES

Ordinary fabrics absorb these overtones in music and sibilants in speech. Tygan High-Fi Fabric lets them through, allowing your set its greatest range of sound. This is why every major TV and High Fidelity set manufacturer in Australia uses Tygan.

Tygan is available in a wide range of designs and colour combinations from the following suppliers:

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General Accessories Pty. Ltd., 100 Clarence Street, Sydney.
Radio Despatch Services, 841 George Street, Sydney.
United Radio Distributors Pty. Ltd., 175 Phillip Street, Sydney.

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J. H. Magrath & Co. Pty. Ltd., 208 Little Lonsdale Street, Melbourne.
Master Elec. Pty. Ltd., 547 Elizabeth Street, Melbourne.
Electronic Developments, Nicholas Buildings, 37 Swanston Street, Melbourne.
Homecrafts Pty. Ltd., 290 Lonsdale Street, Melbourne.

SOUTH AUSTRALIA

Gerard and Goodman Ltd., 192-196 Rundle Street, Adelaide.
Newton McLaren Ltd., Leigh Street, Adelaide.
General Accessories Pty. Ltd., 55 Flinders Street, Adelaide.
Limber Radio Co., 16 Charles Street, Adelaide.

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of man-made diamonds has been most rapid. Early in 1955 25 carats produced by apparatus in the research laboratory were used in abrasion tests and demonstrated that man-made diamonds would perform as well as natural diamonds.

Soon after, a man-made diamond wheel was tested for comparison with natural diamond wheels and proved to be superior. Subsequent tests and actual use in production proved the superiority of man-made diamonds over natural diamonds in vitreous as well as resin bonded wheels for a number of different uses.

Of particular significance was the discovery that the shape of the diamond crystal varies according to the temperature of formation. Cubes predominate at the low end of the critical temperature range; mixed cubes, cubo-octa-hedra and do-decahedra at the intermediate point; and octahedra at the upper limits of the range.

SHAPE, COLOUR

By controlling the shape and other characteristics of the diamonds it will be possible to tailor them more nearly to the requirements of industry for special cutting, grinding and polishing applications.

Colour was also found to be governed by the temperature of formation, varying from black at low temperatures through dark green, light green and yellow to white at the highest temperatures.

Although many of the physical characteristics of natural diamonds can be duplicated at will, Dr Suits pointed out that the small size of the man-made diamonds keeps them within the range of industrial rather than gem stones.

Several devices were invented by the General Electric scientists for sustaining the ultra-high pressures and temperatures required to change carbon into diamond.

One very successful device, called the "belt" by H. T. Hall, its inventor, makes use of conical, Carboloy cemented-carbide pistons that push into each end of a specially doughnut- or "belt"-shaped Carboloy cemented-carbide chamber. The conical piston has much greater strength than the usual cylindrical piston of high-pressure equipment.

Both chamber and pistons receive support on all sides from a doughnut-shaped structure consisting of several stressed binding rings, from which this device takes its name.

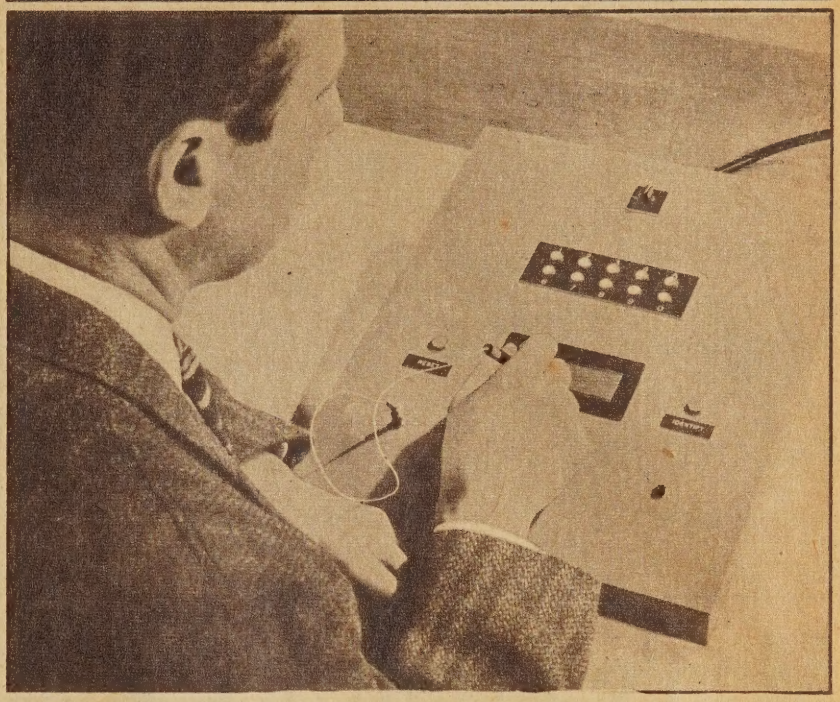
PRESSURE SEALING

A very important feature of the "belt" is its pressure-sealing technique. In this technique, conical gaskets of pyrophyllite, a naturally occurring form of aluminium silicate, are used for the dual purpose of holding pressure and yet allowing motion through compression and flow. A unique characteristic of pyrophyllite is that its melting point is raised from 2,400 deg. F. to 4,800 deg. F. by pressure.

Pyrophyllite is also used to hold the sample, which consists of the graphite and the metal catalyst. The high temperature is obtained by the passage of electrical current through the sample.

The pyrophyllite, in addition to transmitting the pressure of the converging pistons, serves as a thermal and electrical insulation, enabling the pistons to remain comparatively cool, thus increasing their effective strength and extending their useful life.

MACHINE "READS" HANDWRITING



A small device that reads handwritten words has been built at Bell Telephone Laboratories. It has a ten-word vocabulary—"zero" through "nine," spelled out.

THE handwriting reader, about the size of a briefcase, was invented to demonstrate methods which might eventually be applied in machines designed to read a wider variety of material.

"Reading machines" could be valuable in any business or industry where information must now be translated into machine language by punched cards, by tape, and by pressing adding machine or typewriter keys.

In the Bell System, reading machines would help in translating toll tickets, in processing bill stubs and orders for change in service, and in other commercial applications. The handwriting reader is an early experimental step in the study of how such machines can be made.

To use the experimental handwriting reader, the writer moves a metal stylus over a special surface just as if he were writing with a pen or pencil. Then, when he touches an "Identify" button with the stylus, a light appears beside the numeral corresponding to the word he has just written.

READS CURSIVE SCRIPT

The device is believed to be the first which actually reads cursive script — connected handwritten material—despite variations in individual style. It also explores machine reading by entire words rather than letter-by-letter. It does this by picking out features of the overall shape of the word. These include the length of the word, the dotting of "i's" and the number and position of vertically extended letters such as "h" and "g."

Machines are already in use that can read individual letters and numbers, but most require printing in a rigid type style and specific size. Among these are machines for reading the codes that appear on some credit cards.

A device invented earlier at Bell Laboratories reads numbers formed around two dots.

Current pattern-recognition research aims to eliminate or limit constraints — to find practicable, efficient ways for machines to read any reasonably legible material. Many methods have been proposed and are under study.

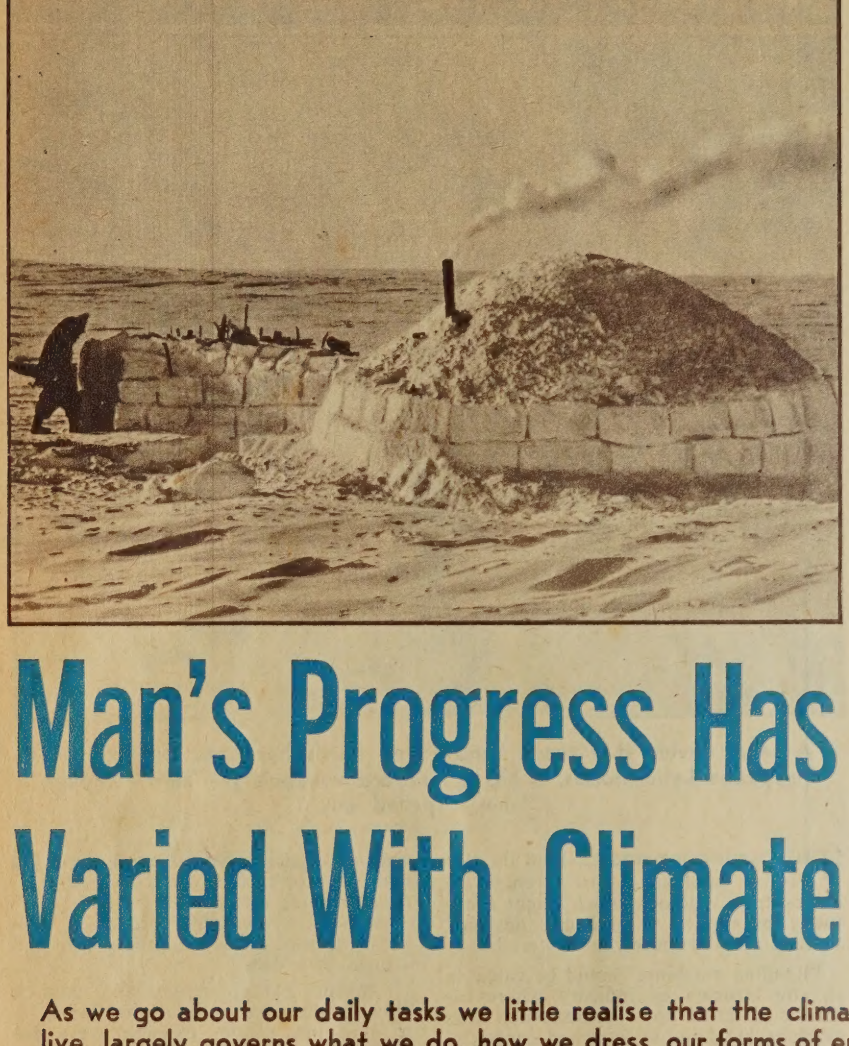
ONE MINOR CONSTRAINT

The handwriting reader has one minor constraint. The user must write within limits on the special surface. Leon D. Harmon, inventor of the device, explains that the stylus, which is wired, makes electrical contact with 15 horizontal metal strips alternately sandwiched between strips of electrical insulating material in the surface.

Up-and-down movements of the writing cause electrical connections to be made with the metal strips in sequence. The sequence and number of connections tell the word-reading device which of the 10 words has been written.

Although the device has enough flexibility to recognise most individual styles of cursive writing, it has limitations. The writer must not print the words nor lift the stylus between letters. He must dot his "i's" punctiliously in the words "five," "six," and "nine." He must play square with the machine.

For a primary-grader among machines, however, the handwriting reader has a high degree of accuracy, scoring 97 per cent in a test of 1,000 words written by 20 persons. Most of the 3 per cent error rate can be eliminated by minor improvements.



The eskimo's continuous battle for existence with the elements has left him little time or incentive for much else.

Man's Progress Has Varied With Climate

As we go about our daily tasks we little realise that the climate of the region in which we live, largely governs what we do, how we dress, our forms of entertainment, the food we eat, the type of our manufactures, our mode of transport, our health, our financial transactions, our temperament, the kind of houses we live in and our state of prosperity.

by Calvin Walters

THERE are many who believe that all these are governed by the position of the planets from time to time or some other such factor. Whether this is so I am not prepared to argue, unless the planets influence climate, for there is overwhelming evidence that it is climate which is the master of our affairs.

We live on a rotating globe, which is large enough to hold, by force of gravity ,a vast atmospheric blanket around it. The blanket weighs in the order of five quadrillions of tons (five followed by 15 noughts).

INCLINED AXIS

Within this blanket of air the earth revolves on an axis inclined from the vertical. The influence of the sun upon it brings about seasons which would not occur if the earth were not so tilted on its axis.

This earth of ours is not a true sphere, either. It is a spheroid which has a diameter through the equator about 27 miles more than from pole to pole.

This fact alone is of the greatest importance. If the earth were a true sphere, the gentle downward slope from the pole to the equator would produce a vast deep ocean in low latitudes and an enormous continent surrounding each pole.

Near the poles, such continents would be cold, windy and dry. In summer, violent warm winds blowing from the equator would harass the coastal belt, bringing torrents of rain. In winter, the winds would be extremely cold, as almost to prevent life as we know it.

How the tilting of the earth brings about the seasons and changes of temperature during a year is best illustrated by a diagram devised by the late Ellsworth Huntington, the great authority on climate. We reproduce the picture her which, together with the following e planations, will make the matter qui clear (I sincerely hope).

In the diagram we see the earth r presented, in its relation to the sun, three positions. The upper globe shov the earth at the June solstice. Th middle is the March and Septemb equinoxes and the lower our winter so stice.

In the picture the sun is assumed t be at the right of the globes.

Between the earth and the sun a enormous screen is placed provided wi two slots of equal size.

RAYS FROM SUN

As the earth revolves around the su the same amount of rays will pa through the slots and fall upon th earth.

When the earth is in the top positic the rays will fall vertically upon th Tropic of Cancer and obliquely over th poles. Thus, the heat will be concer trated over a smaller area over Canc and the heating effect will be great than further north. We now have sun mer in the north and winter south c the equator.

At the equinoxes (middle globe) th heat is concentrated over the equatc and less further north. We have autum in the north and spring in the south.

At the position of the bottom glob the heat is concentrated over the Tropi of Capricorn and less further north. W have summer in the south and winter i the north.

These changes of temperature have a enormous bearing on the ways of ever thing which lives on the earth.

It is the temperature changes whic produce such variations in climate b cause of the effect on the atmospher

VARYING DISTANCE

In addition, there is the effect of th varying distance of the sun from th earth at what is called its "perihelior (close to the earth) and its "aphelior (away from the earth).

In January, the sun is approximatel three million miles nearer the earth tha in July. This makes the northern wir ters a little less severe, and the sum mers somewhat cooler than they woul be if the perihelion and aphelion did nc exist. The opposite case exists in th south, where the winters are more sever and the summer warmer.

Thus, the northern climate is mor temperate than the southern.

Is it any wonder then that such vari

tions have such a marked effect on living things on the earth.

The slightest variation of the composition of the atmosphere could mean the difference between life and death as we know it, just as pollution of water can mean the life or death of the creatures which live in it.

Out of this knowledge of the climatic influence on the lives of man and creature has grown a science called "Human Geography," which seeks to study the how and why of the distribution of different modes of life over the earth's surface.

It has fairly well established the fact that, even after studying the physical and mental conditions which have been handed down from ancestors, geography has been the original governing factor.

GENERAL FACTORS

These geographical factors are generally temperature, rivers, mountains, deserts, rainfall, forests, oceans, wind, snow and ice.

Everyone knows from experience that cool weather is the best for producing the human energy for work and though, whilst hot, humid weather is enervating, producing no desire for work, dulling the senses and producing inefficiency and a high industrial accident rate.

Extremely cold climates have a similar effect. The cold prevents practical application of constructive thoughts because of the difficulty of carrying them out and because of the hindering effects of clothing and heating needs and the difficulties of food production.

It could be expected then that it is in the temperate climates that the greatest progress has been made.

There is a sort of climatic energy which can produce either the man, the machines, the goods or the Government.

As Ellsworth Huntington points out, energy and health have a distinct relation to character. A stimulating climate tends toward good health and to be industrious becomes a desire. People want to invent things, try out reforms and new methods. The strength is born of energy, not the continual exercise of will power that is required under extreme climatic conditions.

BETTER CONTROL

People can control their tempers more easily, they are more sober and can tell the truth more easily.

It appears that a monotonous climate such as is experienced in the Bahamas where there is little change in weather conditions from day to day tends to dull the intellect. The climate is very pleasant being warm and tropical but with very little change.

The country, however, is rather backward, many never having learned to read or write. There is little incentive to foster new ideas, for the climate makes people listless and lazy.

Most of the United States and southern Canada, however, which enjoys a more stimulating climate have made great progress.

This progress has been shown, by scientific "Human Geography," to be almost universal throughout regions where cyclonic storms prevail.

By cyclonic storms we do not necessarily mean violent, disastrous storms and hurricanes, although these are part of the weather system which prevail in the areas under discussion.

A look at a weather map in the daily paper will generally disclose a well defined system of high and low pressures moving from west to east over the Australian continent. In meteorological language the highs are called anti-cyclones and the lows are called cyclones.

DIRECTION OF WIND

In a cyclone the wind revolves around the centre in a clockwise direction and in an anti-cyclone it revolves around the centre in an anti-clockwise direction.

In a cyclone region the weather is usually dull or raining, whilst an anti-cyclone produces fine, clear weather with warm days and cool nights.

This succession of cyclones and anti-cyclones are more numerous and better developed in winter months because of the greater contrast between the character of tropical and polar masses of air.

During their west to east passage across continents these storms, as they are termed, do not follow a fixed course but may vary to the north or south according to whether it is winter or summer.

The changing conditions brought about by the storms result in fairly moderate rain during all seasons with cool winters and warm to hot summers.

A most important characteristic is the marked change of weather every few days. During a year, the areas influenced by cyclonic storms may experience the weather of every part of the world.

It is this continual change of weather which make the cyclonic regions favourable to the advancement of civilisation, because monotony is removed and the climate is most suitable for agriculture.

The cyclonic climate extends over two main belts of land surface. It traverses North America, the United States and the south of Canada, the major part of Europe, southern Scandinavia and Germany, Great Britain, France, Australia and New Zealand, part of Asiatic Russia, parts of China and Japan.

If we look at the statistics of these countries we will find a significant feature of progress throughout the centuries which is in marked contrast to those countries situated outside the belts of cyclonic influence.

Practically all of the world's most progressive countries lie within the region. Here commerce, manufacturing and agriculture has reached their highest peaks. Most of the world's minerals are mined and more food is grown than elsewhere.

GREAT MEN

Inventors and technicians from these countries build most of the world's great railroads, bridges and buildings, not only in their own countries but in other areas.

The people of these areas govern most of the world and produce the great

While this man squats and swelters, time and opportunity pass him by!

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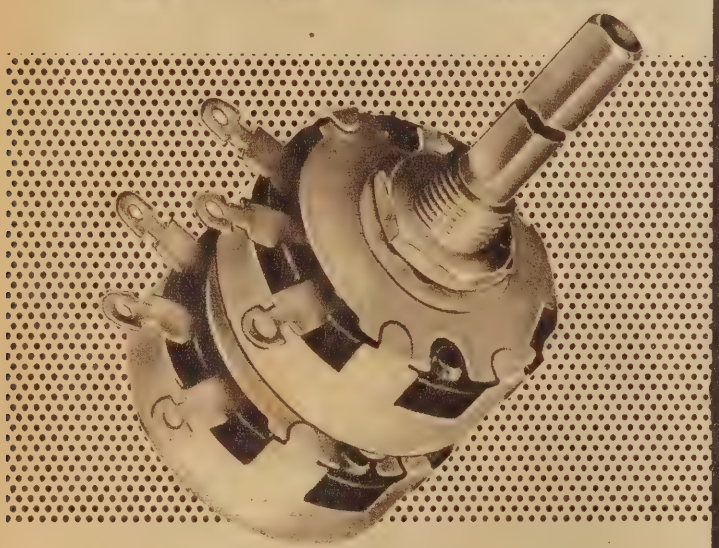

Only I.R.C. CS Controls incorporate Radio & TV's two most effective noise eliminating features!

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MULTIPLE FINGER CONTACTOR

These features insure superior *NOISE FREE* performance under all operating conditions.

SILENT SPIRAL CONNECTOR

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MULTIPLE FINGER CONTACTOR consists of five silver-plated phosphor-bronze springs which are independent of each other and have a "knee action" effect as they move over the element surface. The contact pressure of each spring is accurately adjusted to give correct pressure on the element for minimum noise level consistent with long life.

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A table recently compiled by Ellsworth Huntington shows that the cyclonic regions produce practically all the cereals we eat, all the vegetables, most of the fruit, all the flax, hemp, hops and timber, all the horses, cows, poultry and sheep, all the coal, petrol, stone, cement, salt, nitrates, potash and so on.

A great number of minerals are present in lands of non-cyclonic influence but the people have not the energy or initiative to mine them. The same applies to certain cereals but the people grow, reluctantly, just enough for their own requirements.

There are large deposits of coal in China but most of that mineral is imported from cyclonic countries. It is a characteristic of non-cyclonic countries that, while they may have abundant resources of many commodities such as oil, coal and so on they have not the geographical energy to develop them. This is left for technicians and financiers from cyclonic countries to do.

LEADERS IN CULTURE

In the fields of culture such as music, philosophy, and art the people of cyclonic countries have always been pre-eminent. They produce the greatest political leaders as well as the most energetic rebels.

In sharp contrast to the cyclonic areas where the continual changes of weather conditions add variety and spice to life, are the weather conditions and lack of progress of the tropical areas.

Here, particularly in the lowland areas, the land is covered by a moist heat, monotonously continuous, which makes activity almost impossible. Even the natives who have been reared in such an environment are lazy and white people who have taken up residence in those lands soon fall into the same habit of sluggishness. Thus there is a continual battle against the enervating climate and white people usually try to get native "boys" to do all the work.

Studies in "Human Geography" have revealed some interesting facts. As most of these studies have been carried out in the U.S.A. the facts given here are for that country but will apply to any country having the same climate.

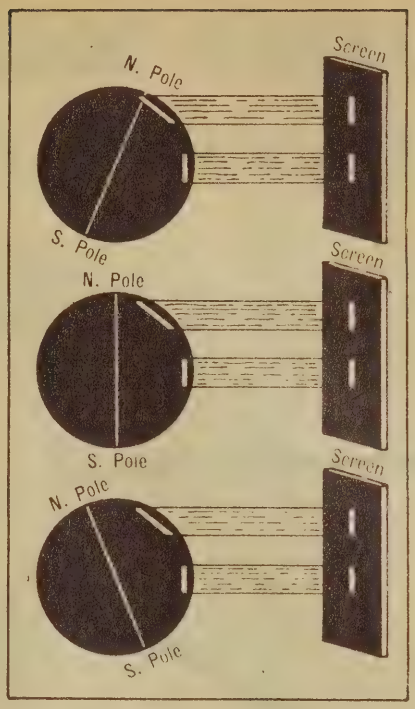
It has been found that there is what has been termed an "optimum season," when efficiency runs high and illness is at a minimum. This for north-eastern U.S.A. is in the autumn in October. People work harder then. They go to work more readily and produce more efficiently.

WINTER CYCLE

When the really cold winter comes on there is more sickness and the worker produces less until the warmer weather comes on in spring. Workers' output then begins to rise and illness diminishes.

Whether this continues during the summer depends on the degree of heat and humidity. Both the latter again reduce output and increases illness.

An interesting point, however, is, that, while cool conditions stimulate bodily activity, the mind works better in cooler temperatures still. This has been shown by the fact that students in schools and universities have higher marks in examinations a month before spring and a month or two after autumn. This fact may be of advantage to students. There are also more applications for patents to the patents' office during those periods.



This well known diagram shows how tilting of the earth's axis influences the area over which a given quantity of sunlight is spread.

It has also been found that there are three main conditions of climate which have certain optima namely, temperature, humidity and variability. There is a certain ideal condition for each of these, which is of importance for health and energy.

Every living thing has an optimum temperature, in which it lives most vigorously. It varies somewhat with the type of activity or occupation.

HIGHER TEMPERATURE

People who work in insurance offices or banks work better at a slightly higher temperature than those engaged in playing football or working in brickyards. Very young people require a higher temperature than those from 12 years of age onwards. Old people require a higher temperature than middle-aged people.

The best all round temperature is an average of 64 degrees day and night, taken together. This means that if the temperature falls to about 55 degrees at night and rises to about 75 degrees by day we will be living under the optimum temperature conditions for best health and energy.

For mental work the best temperature is a good deal lower. For this, the temperature should be near freezing at night and about 55 degrees by day.

Of course, all the above are related also to the humidity at any particular temperature. We can stand great heat, to the century mark, if the humidity is low, say 30 per cent. But if the temperature and humidity are equal and one perspires at the raising of a finger, then we feel exhausted and wilted.

The best operating conditions seem to be when the outdoor temperature is at about the optimum of 70 degrees by day and the water vapour in the air is such that heavy dew falls at night.

Variability of weather has already been discussed under cyclonic climate. It only remains to find just what is the ideal climate for man to be at his healthiest and wealthiest.

The facts gathered give the ideal climate as one where the average temperature ranges from about 40 degrees in the coldest month of the year to 75 degrees during the hottest month. There should be plenty of storms, and wind blowing from the sea, so that the relative humidity is high except in the hottest weather.

CYCLONIC SYSTEM

There should be rain at all times of the year and finally a cyclonic weather system where there is a constant succession of high and low pressures throughout the year. Obviously no country can give us the perfect climate, but England and parts of the European continent close handy are closest to it.

New Zealand, British Columbia and Northern United States come next, together with the south-east corner of Australia.

Southern Australia and New Zealand are, perhaps, more favourable than Northern United States because we have the effect of nearby oceans to moderate winter cold and summer heat. We have ample variety from cyclonic storm systems. It is no accident that Southern Australia has made such great progress compared to the rest of the continent. We have near enough to the right climate to produce the necessary stimulus for progressive energy and thought.

It is because of the knowledge that people work better under cool conditions that has led to the wide-spread adoption of air-conditioning in offices, factories, homes and shops. This is an attempt to have a made-to-order climate. While this is somewhat effective and such buildings are pleasant to work or live in, there are certain handicaps and hazards which have not yet been overcome.

We have all been affected by the peculiar sensation of going from a cooled building into the stifling heat of outdoors or vice versa.

The sharp contrast between the outdoor and indoor temperature is something the human system cannot adapt itself to.

AFFECTS BREATHING

Medical studies seem to show that it is not so much the effect upon the skin which brings about this reaction. It appears to be associated with our breathing apparatus.

If an individual can inhale cool air, external heat seems to affect him much less. Sudden changes in temperature so disturb the blood supply to the mucous membranes of the nose and in the sinuses that respiratory troubles can be accentuated by passing several times a day from cool buildings to hot outside air and vice versa.

Thus we see that all our progress throughout the ages has been governed by the climate in which we live. It can truly be said that it is not clothes which make the man but the climate.

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Technical Review

ZENER DIODE REGULATES VOLTAGE TO HEATER

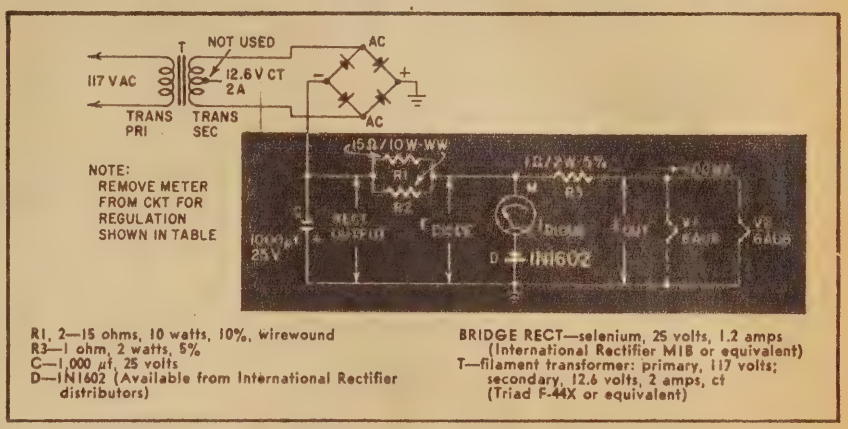
Though developed only recently, numerous applications are being found for zener diodes. In the one outlined below, a 10-watt zener diode solved the problem of regulating the supply to a critical value heater.

DURING the development of an extremely critical oscillator circuit we needed a regulated heater supply for the oscillator.

Several methods of regulation were tried. The circuit shown proved to be the most reliable and gave the best results.

This circuit uses a Zener diode as the regulating element. Circuit action of the diode is similar to that of a voltage regulator tube.

If we wanted to regulate the plate voltage of an oscillator tube, we might use an 0D3/VR150. When an 0D3/VR150 conducts, the voltage across it is held quite close to 150—within the tube's current-carrying capabilities.



R1, 2—15 ohms, 10 watts, 10%, wirewound
R3—1 ohm, 2 watts, 5%
C—1,000 μf, 25 volts
D—1N1602 (Available from International Rectifier distributors)

BRIDGE RECT—selenium, 25 volts, 1.2 amps (International Rectifier M1B or equivalent)
T—filament transformer: primary, 117 volts; secondary, 12.6 volts, 2 amps, ct (Triad F-44X or equivalent)

Circuit of the regulated supply. As shown, it was used to supply two tubes in the oscillator circuit. The high-voltage supply used 7 tubes and a Zener diode.

VOLTAGES OF REGULATED SUPPLY

TRANS PRI (Ac Volts)	TRANS SEC (Ac Volts)	RECT OUT (Dc Volts)	E DIODE (Dc Volts)	I DIODE (Ma)	V OUT REGULATED (Dc Volts)	E OUT UNREGULATED (Dc Volts)
105	11	12.6	6.75	100	6.2	7.7
110	11.5	13	6.75	135	6.2	8.2
115	12	13.5	6.8	165	6.21	8.8
120	12.5	14	6.81	200	6.22	9.4
125	13	14.5	6.83	450	6.23	9.9

Zener diodes are made for many voltage ranges. Their operation is based upon sudden conduction of current at a specified voltage, with the voltage remaining fairly constant across the diode over a wide range of current.

The table tells the story by showing the regulation the circuit gives. Over the critical range of 105 to 125 line volts, heater voltage varies only .03 volt.

With the Zener diode disconnected (last column in the table), heater voltage varied 2.2 volts. This is an improvement of 55 to 1.

AC ripple across the oscillator's tube heaters measured about 0.15 volt, which represents a hum voltage of —50 to —55 db. Although not important here, it might prove useful where low hum modulation of a radio-frequency carrier was desired.

Even a very small resistance in series with the Zener diode will disrupt its regulation.

An ammeter was connected in series with the Zener diode to measure its current (Idiode), while Tpri voltage was varied.

Then the ammeter was disconnected and the input voltage was again varied to check regulation and to get the remaining readings in the table.

A slight improvement in regulation was noted when a good soldered connection was made to the Zener diode in place of a clip lead.

The particular Zener diode used can dissipate 10 watts into a heat sink. In this particular circuit, the diode is used well below its maximum current and wattage ratings.

The load consisted of a pair of 6AU6 tubes connected in parallel, which drew 600 mA (as shown in dashed lines in the figure above).

By H. C. Stratman, Engineering Dept., Gates Radio Co. (From "Radio-Electronics").

BRITISH-MADE "CRASH RECORDER"

A NEW British device called a flight and crash recorder was described by its inventor, Kenneth Dobson, in a recent B.B.C. broadcast. During a flight the device records all important facts, such as instrument readings, engine performance and all the stresses and strains on wings and landing gear.

Should there be a crash, it will give the investigators something to work on; if the flight is perfectly normal, it will provide maintenance engineers with a record of the plane's performance that may result in not having to replace parts as often as at present.

Mr Dobson said that there would be 70 or 80 different things to be recorded and the device would continue recording for up to 160 hours. The cost was about £stg2,500, but it offered considerable economic advantages. Engines and parts of the aircraft structure wore at a rate which depended on how they were treated.

For example, one hour at full throttle from an aircraft engine caused as much wear as 20 hours at half throttle; but at present it was only possible to tell how long an engine had been running, not how hard, and therefore "wildly pessimistic" guesses about performance had to be made in order to allow a safety margin.

The new device would record how long, and exactly how hard an engine had been running and would in effect give an accurate figure of wear which might extend the life of engines by as much as 300 per cent.

In the event of a crash, Mr Dobson said, ninety-nine times out of a hundred it should be possible to recover the record, which would show everything that had happened in the aircraft.

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- ★ Tape record stereo records onto it
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- ★ Special trick button for multi recordings

FREE! A Free Reel of Long-Play Tape to all buyers of new Tape Recorders who bring in this coupon!

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CHOOSE FROM AUSTRALIA'S GREATEST RANGE OF TAPE RECORDERS — FROM £65 — or £10 deposit—all the famous names . . . GRUNDIG . . TELEFUNKEN . . PHILIPS . . PYE TECHNICORDA . . A.W.A. . . ELCON . . etc.

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H.M.S. VICTORIOUS FITTED WITH 3-D RADAR SYSTEM

Electronic Systems aboard H.M.S. Victorious, the gallant veteran of Coral Sea days now rebuilt into an atom-age carrier, have excited a good deal of admiration and envy from U.S. Navy carrier men.

PRINCIPAL reason is her aircraft direction system, which, in Atlantic games with American carriers during July, enabled her to score an overall average of 90 interceptions to 30 for U.S. carriers.

Hottest thing aboard the Victorious is her model 984 radar, which gives her direction officer (equivalent to a U.S. combat intelligence centre officer) not only range and bearing to all targets, but altitude of any selected targets.

Planning interception patterns is thus materially simplified.

This system, combined with the latest in combat intelligence centres (called aircraft information organisation aboard a British carrier), makes it possible for three carriers and associated air pickets to maintain complete surveillance over a 1,000-mile sea frontier.

"3-D" RADAR

The 984 is one of the first successful "three-dimensional" radars. It can acquire altitude data about a target without tracking it and running its polar coordinates through a computer (which is the way a gun-laying radar gets its altitude data).

Result: It can maintain an area surveillance and at the same time produce the slant range, pointing angles and altitude data needed to plan fighter intercept patterns.

Details of the 984, its associated computer, and the information centre where radar data are translated into combat intelligence, are under tight security wraps. But officers of the ship were able to disclose some operating principles recently to observers from the U.S.

The 984 sends out a number of narrow beams stacked vertically to cover about a 50-degree vertical slice of sky and still permit discrimination in elevation angle.

Azimuth discrimination is achieved conventionally by rotation of the tower (or nacelle, as the housing is called).

British naval authorities could not disclose the number of beams, but they probably number about two dozen.

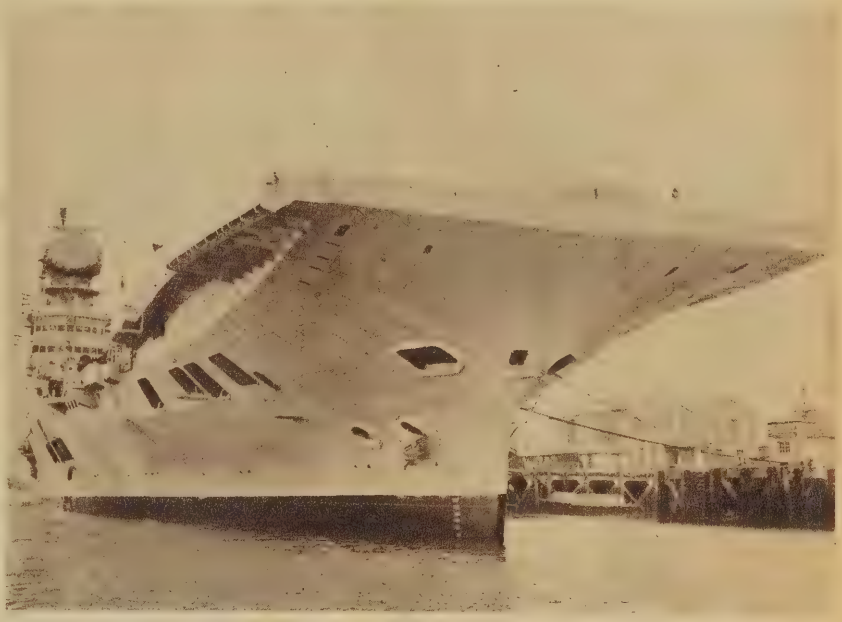
EARLY WARNING

Of these, one, close to the midpoint of the vertical sector (aimed about 25 deg. above the horizon), is at a different frequency from the other, is fixed in elevation, and is used for long-distance surveillance and early warning.

The others scan vertically in small fractions of the whole possible elevation angle covered by the radiating array, and provide the fine elevation discrimination needed to compute altitude.

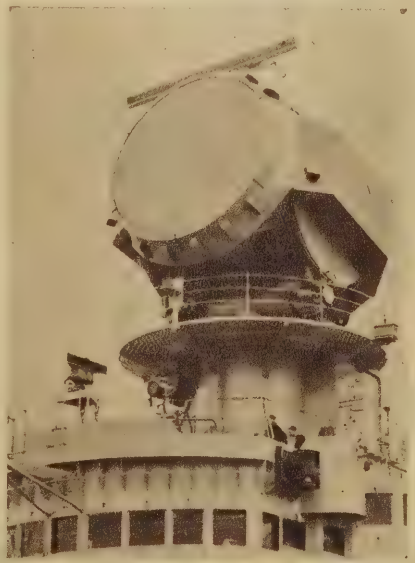
Each beam has a separate receiver channel, with automatic frequency control to correct for frequency variations in the magnetron. The energy is directed by a microwave lens about 14ft in both diameter and focal length.

Plan-position data are presented on several consoles in the aircraft information organisation. Computer and comprehensive display system were engineered by Pye Ltd.



Though 17 years old, H.M.S. Victorious is probably the most up-to-date aircraft carrier in the world. Vital changes include a radically new type of radar system which is all the more effective because its information is "processed" and stored electronically.

When a direction officer determines that a target is putatively hostile, an operator passes the bearing and range of that target through an associated computer, which determines the elevation from which the strongest return is coming and computes the triangle to derive altitude.



The superstructure of H.M.S. Victorious is dominated by this huge radar aerial which monitors continuously the height, range and bearing of aircraft or missiles.

Then all known data about that target are stored in the computer, subsequently to be updated as needed.

C.I.C. and direction officers can interrogate the computer store about any target; if the target is being "watched" and the data are in the storage unit, the presentation appears on a ppi-type scope on the interrogation panel, of which there are many in the information centre.

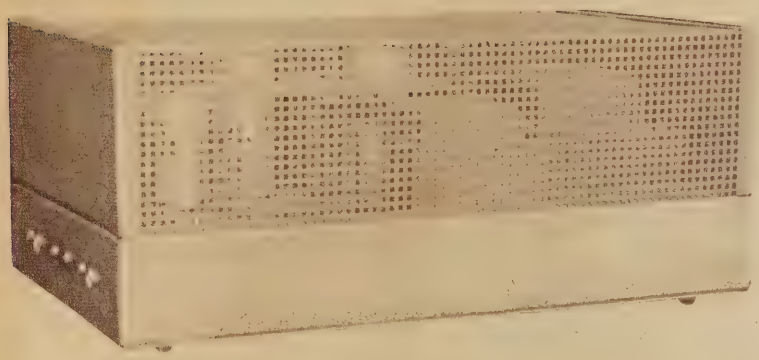
At each of these locations, too, is a smaller analog computer which translates target data, plus position data of one or more of the carrier's fighter planes, into an intercept course.

C.C.A. SYSTEM

Also new on the Victorious is a Ferranti radar system for talking down aircraft in foul weather. The carrier-controlled approach (C.C.A.) radar is one of the first ever designed specifically for shipboard use.

The C.C.A. system has a "variable drive" mechanism which permits close timing of landings. If it is necessary, for example, to land six craft in five minutes, this mechanism figures out a 50-second separation pattern and provides the C.C.A. officer with the necessary path data to talk the planes down. (From "Electronics.")

MiL FOR STEREO SOUND



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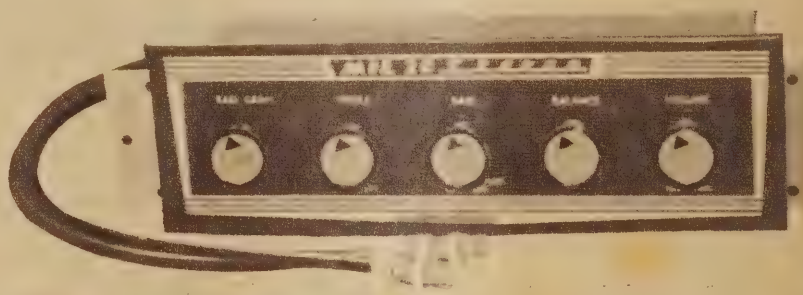

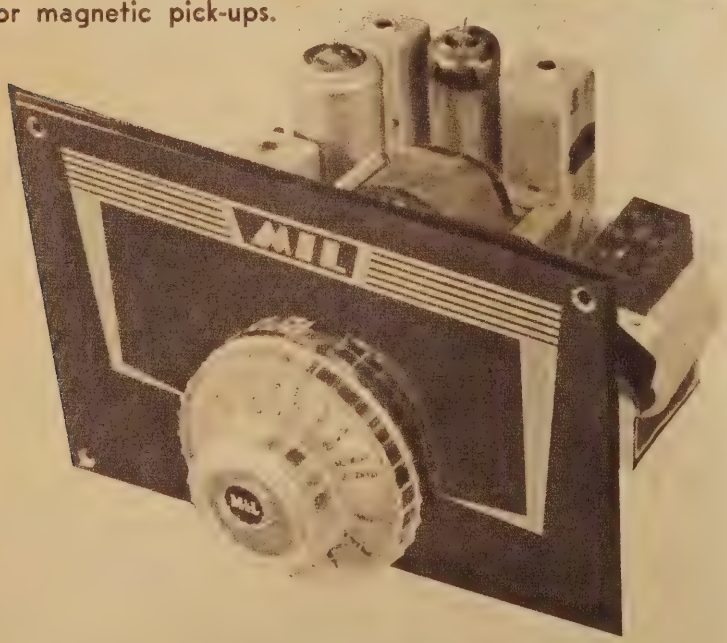

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SEVERAL RECORDINGS SUPERIMPOSED ON ONE TAPE

This scheme would appear to have several serious limitations but it may work well enough to be of interest to some tape recorder fans. We reprint the article with much the same reservations as the magazine "Audio", in which it orginally appeared.

By W. D. Bell

WHAT would you say to making 10 different recordings, one on top of the other, on a ¼in magnetic tape with a conventional single-track head? And then playing **any** of the recordings at will?

Sounds impossible, doesn't it? Yet, at least two computing-machine laboratories have independently discovered this recording trick—a method you can try for yourself on your own tape machine.

Recording multiple tracks on the same section of tape is easy, of course, if separate heads are employed and the tracks are kept separate.

This was the method used in an elaborate system, built by Ampex for Les Paul and Mary Ford, which recorded eight tracks on one-inch tape. With separate record, erase, and playback controls for each track, this Ampex-built machine was ideal for the multiple recording techniques for which Les Paul is famous.

NOT THE METHOD

However, recording separate and distinct tracks on different parts of the tape is not the method I am describing here. Rather, one track is recorded right on top of another, as stated before.

The guided-missile people also record several separate channels of data on one track. Each measuring transducer modulates an audio tone of restricted band width. A number of transducer signals are then mixed and the composite signal radioed to a ground receiving station.

The tape-recorded signal can then be played back through appropriate filters and each separate signal isolated. Thus, the telemetry method works because there is no overlap of the frequencies of the various channels. Again, this is not the method described here.

What, then, is the method that permits multiple recordings to be made on top of each other? The answer, quite simply, is to change the angular orientation of the head gap with respect to the tape for each recording. To play back, a recording is selected by choosing the same angular position for the head as was used for the original recording.

GAP ALIGNED

In normal operation, the head gap is accurately aligned at right angles to the tape. Ampex claims in its literature that this azimuth angle is held to plus or minus a single minute of arc.

Why is such an accurate manufacturing specification imposed? What if the head is not accurately perpendicular to the tape?

In reply, if a tape recorded on an accurate machine is played back on one with a bad azimuth angle adjustment, the signal strength will be reduced. Worse yet, there will be distortion. In fact, if the azimuth angle is deliberately increased, the output will become increasingly garbled until it finally can no longer be heard.

These are the reasons a recorded tape can sound horrible when played on a home machine. While you can indignantly return the tape to the dealer, it may be that the playback machine is the villain.

If the azimuth angle of the playback head is out of adjustment, then it can't possibly sound right. By the same token, if the head on the machine that made the original recording is out of adjustment, then the tape will sound poor on any well-aligned playback equipment.

SAME MACHINE

Recognising this alignment problem, a logical question is: what happens if a tape is both recorded and played back on the **same** machine, when the azimuth is not critically adjusted? As the great number of inexpensive tape machines clearly shows, reproduction is surprisingly good.

Just how far the azimuth angle can be modified is demonstrated by a special modification supplied by Rangertone, Inc. An extra head is mounted on stock machines with the gap **parallel** to the tape!

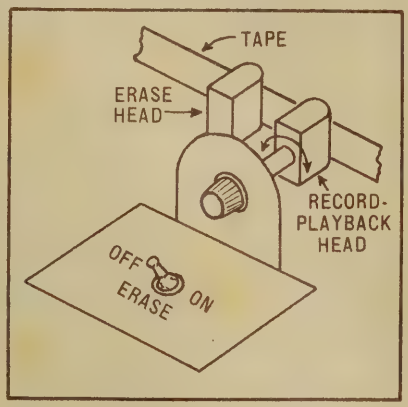

Figure 1: This diagram illustrates the basic idea put forward by the author, though a more rigid method of mounting would probably be desirable in practice.

The head is used to record 60 cps along with either single-channel or two-channel material on ¼in tape. Although the 60 cps track is in the middle of the tape, the standard heads, perpendicular to the tape, don't even "see" the special track.

The purpose of this third track is to synchronise tape playback exactly for movie making.

The above facts furnish a background for understanding the phenomenon of superimposed tape recording. If you'd like to experiment yourself, do this:

1. Mount the record-playback head on a pivot along with an angular pointer or indicator. Figure 1 is a suggested plan, although the head should be closer to its mount.

2. Fix the erase circuit so it can be disabled with a switch. Obviously, rerecordings can't be made if the previous information is erased.

WHAT TO DO

That's all there is to it! Recording procedure is as follows:

1. Erase the tape.
2. Disable the erase circuit.
3. In separate steps, record different material, always rewinding and starting over at the beginning of the tape. In doing this, remember to set the azimuth angle to a **new** position for **each** recording.

What angle should be used? That depends upon your heads, tape speed, and other factors. A good trial value is increments of 15 deg.

After a tape has been multiple-recorded, how is playback accomplished?

1. Set the indicator on the head to the angular position that will select one of recordings.

2. Play back and listen!

You'll soon discover that on playback you can "tune" the head to an accurate point of satisfying high-fidelity standards. If that could be done, then very interesting possibilities exist.

A seven-inch reel of long-play tape runs for a full hour at 3¾ ips. With 10 recordings on the tape, it would play for a full 10 hours! This is not only competitive with L.P. records—it is superior on a straight dollar-and-cents basis. The cost of reproduction should not increase, since multiple heads could be placed "in-line" and all recordings made in a single pass of the tape.

Intriguing?

200,000 PICTURES PER SECOND

BRITAIN has developed a cine-camera capable of taking 100,000 pictures a second.

But armament research scientists are demanding an even faster camera and it is being stepped up to take 200,000 pictures a second.

This was revealed when some of the secret work of the Fort Halstead Armament Research and Development Establishment was recently shown for the first time.

The camera has been developed to record in detail what happens when shells are fired and explosions take place.

The speed of 100,000 pictures a second achieved to date is 4,000 times faster than the normal speed for cine pictures.

Both colour and black-and-white film is being employed in the experiments.

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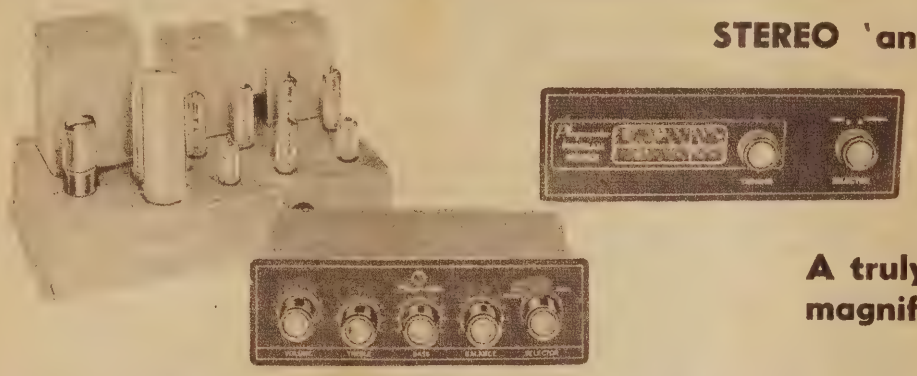
STEREO 'and MONO'



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We offer you a complete range of Playmaster amplifiers, control units and tuners, all faithfully to "R., T.V. & H." specifications and design

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110° TV KIT . . .

Remarkable for its simplicity of layout and efficiency in operation, this is the very simplest possible TV set to build. The kit is complete to the last nut and bolt. Everything is included, ready drilled chassis, picture tube wired, Q+ IF strip matched to Q+ tuner, A.W.A. deflection components and everything best quality fully to "R. T. V. & H." specifications.

FRINGE AREAS. Yes, the kit is available for fringe areas with Q+ Mark 3, four stage IF strip.

CABINETS We offer you the choice of a high quality, fully veneered cabinet or a kit of parts to build your own.

LOW COST. The cost of the kit is amazingly low, and furthermore, we deliver free to capital cities.

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Dear Sirs,
Please send me full details of the following:
(mark square for information required)

☐ Playmaster Hi-Fi ☐ 110 deg. TV Kit

NAME

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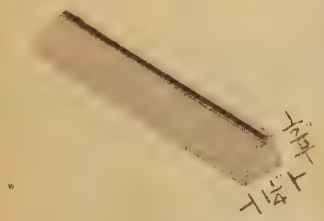
ELECTRONIC REMOTE CONTROL UNIT
This A.J.A.R. unit gives armchair control of brightness and sound/volume. It's amazing, can be fitted in a few minutes, and is supplied with detailed fitting and operating instructions for all "R., T.V. & H." TV designs.
PRICE, complete with 20ft cable £5/5/.

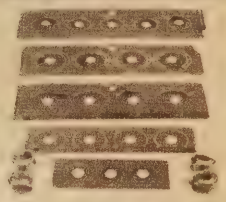
Playmaster control unit boxes, ready drilled complete with front panels and brackets. High quality hammertone finish. Full range of Playmaster amplifier and tuner chassis also available.

Kits of parts available to make your own hi-fi equipment cabinet and 12in speaker enclosure. All panels precision cut from solid 7/8in selected timber.

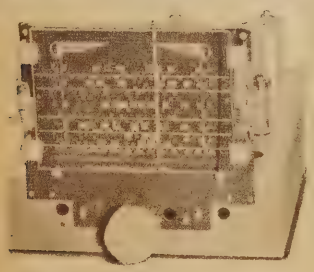


High-grade timber moulding, complete with gold coloured metal insert. Same type as used on highest quality TV cabinets.

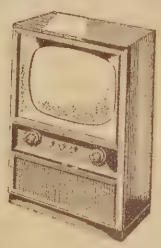
Complete kits plus ALL accessories and spares for the "R, TV and H" TV Sets and Playmaster Hi-fi equipment.



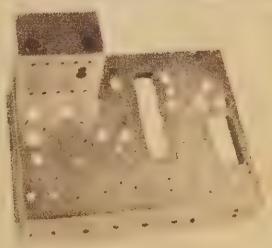
Anodised metal labels to suit various Playmaster amplifiers, control units, and program source. Mono' labels, maroon background with silver lettering. Stereo coffee brown and gold. Beautiful knobs with gold metal centres to match.



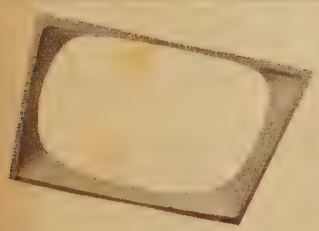
Some very fine hi-fi tuners are included in the Playmaster range. See Playmaster specification sheets for full details.



Timber kits to construct the 110 degree TV cabinet. Everything precision cut. All parts included, glass, mask, beading, gold insert, speaker grille, etc.



TV chassis, specially made for "R.T.V. and H." 110 degree circuit. Cadmium plated, and then passivated to avoid fingermarks. Complete with E.H.T. box, and all holes drilled.



The very best plastic TV masks as used on the finest commercial sets. 21in and 17in. Also available metal reducing mask, hammertone finish to enable 17in set to fit in 21in cabinet.

Q plus Mark V I.F. strip, ready wired and aligned for the 110 degree TV set. If purchased with the Q plus tuner, we will supply them matched.
For fringe areas Q plus Mark III and IV I.F. strips are available.

Set of 5 high-quality TV knobs for 110 degree TV set. In coffee brown or ivory, with attractive gold coloured, trim station numbers on tuning knob.

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(opp. GRACE BROS.) PHONES BA4891, BA4892-3.

AN AMAZING PERFORMER

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Extremely shallow housing which enables greater space economy with printed-board layouts.

Features of the new MSP 2¾" Speaker Model 275JA

ADVANCE TECHNICAL DATA

MSP Type 275JA.

Power Handling Ability	500 mW Program 750 mW Peak
Assembled Speaker Resonance	300 ± 50 c.p.s.
High Freq. Response	5000 c.p.s.
Voice Coil Impedance	15 ohms at 400 c.p.s.
Air gap flux Density	7600 gauss
Total gap flux	10500 lines
Principal Dimensions :	
Overall diameter	2-11/16"
Baffle opening diameter	2-7/16"
Voice Coil diameter	17/32" Nominal
Depth from Clamp Ring to Rear	1-1/8"
Finish : Cadmium plated Housing and Magnet Case	2-1/4 ozs.
Order Part No. 50001	

ASSOCIATED TRANSFORMERS

Transistor Driver

Part No. 38155A

Associated : Transistor : 2N408 { 2N408 / 2N408

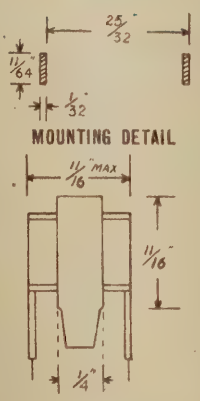
Impedance: —5800 ohm: 3000c.t.

Ratio :

Primary Inductance :
1) Sec. o/c 1v 50c/s + 1.5ma D.C. = 4.7H.
1) Sec. s/c 1000 c/s = 20 mh.

Resistances :
Primary = 300 ohm ± 10%
Secondary = 300 ohm ± 10%

Note :
Secondary winding is Bifilar.



Transistor Output

Part No. 38158A

Associated : Class B—2N408

Transistor : 9v Battery

Impedance : —540 C.T. : 15 ohm.

Ratio :

Primary Inductance :
1) Sec. o/c 1v 50c/s = 1.2H
2) Sec. s/c 1000 c/s = 2.5 mh.

Resistance :
Primary = 50 ohm ± 10%
Secondary = 1.4 ohm ± 10%

Note :
Primary winding is Bifilar.

Developed specially for small transistorised receivers but with a host of other useful applications

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NEWS AND VIEWS OF THE MONTH

Smaller sub. crews

THE average crew of an atom-powered submarine soon may be reduced from 100 to 12 men. This saving promises to result from a revolutionary new submarine control system now under development, according to the U.S. Office of Naval Research.

The new system, called "subic," represents the last achievement to date in using mechanical brains to direct a highly complicated operation. The commanding officer and his aide will continue to make the ultimate decisions, but everything will be made much easier for them and they will not need much human help.

The submarine will steer its own course, keep constant track of its position, spot any enemy craft or obstacle in the water, and keep the interior always comfortable for the crew.

In linking man and machine so closely, according to a report, the designers must integrate five fundamental control systems: for the ship, engineering, communications, weapons and environment. All must be kept constantly and at once in the "mind" of the system.

"It is like a man with a hundred hands and one brain, the brain directing all the hands at once," it is stated.

"The function of environmental control is concerned with the regulation of the submarine's internal environment to ensure that all conditions affecting man's efficiency are maintained at an optimum level.

"These features are logically adapted to both small 'killer' submarines and large ballistic missile submarines. The new system may permit the reduction of the present average 100-man crew to 12 men."

★ ★ ★

Concrete bonds

IN reinforced concrete fabrication, formwork is usually coated with oil to prevent the concrete sticking to it.

An investigation by Mr H. E. Vivian and Mr J. A. Roberts, of the Cement and Ceramics Section of the C.S.I.R.O. Chemical Research Laboratories, Fishermen's Bend, Victoria, indicated that certain greases were more efficient than oil.

Plastic film liners or hard coatings formed from epoxy resins applied as paints were even better. Commercial trials with resin-coated forms are in progress.

During this work it was noticed that epoxy resins adhered strongly to wet concrete when allowed to cure as the concrete hardened. The bond between concrete and reinforcing rods is strengthened nearly fourfold by coating the rods with epoxy resin paint just before emplacing the concrete.

It was found that a similar increase in strength can be obtained by using cured epoxy resin to bond a layer of sand to reinforcing rods, which are then used in the normal way. Such an improvement could have a marked influence on the design of reinforced concrete, and patent applications have been made on both these methods.

Brick walls

EXPANSION of some clay products when exposed to moisture may cause faults in buildings unless adequate precautions are taken. Because of the importance of this problem, the C.S.I.R.O. Division of Building Research at Highett, Victoria, is investigating the moisture expansion of a wide range of clay products, particularly bricks.

Observations have been made throughout Australia. It was found that bricks start to expand immediately they leave the kiln. The amount of expansion varies with the type of brick. With one type, a wall built with bricks fresh from the kiln may eventually expand as much as 2.8in per 100ft of wall length. Expansion may cause damage such as cracking, bulging, or shearing of walls more than about 30ft long.

The investigation, reported in the Division's Technical Paper No. 6, has shown that damage to brickwork due to expansion may be avoided. Bricks should be well burnt and should be allowed to stand for as long as possible before use as about half the expansion that takes place in five years occurs in the first six months. Mortars rich in lime are preferable to strong cement mortars and expansion joints should be provided at intervals in the brickwork.

NEW TYPE PORTABLE "IRON LUNG"

A portable electronic lung, which weighs only 56 lbs. and gives a patient much more freedom than an iron lung, has been developed in Great Britain by the Pye organisation.

CALLED the Barnet Ventilator, the machine costs less than half as much as an iron lung and works from self-contained batteries which run up to 20 hours without recharging.

Mass production is due to start this month, the tentative price being quoted as £385 sterling.

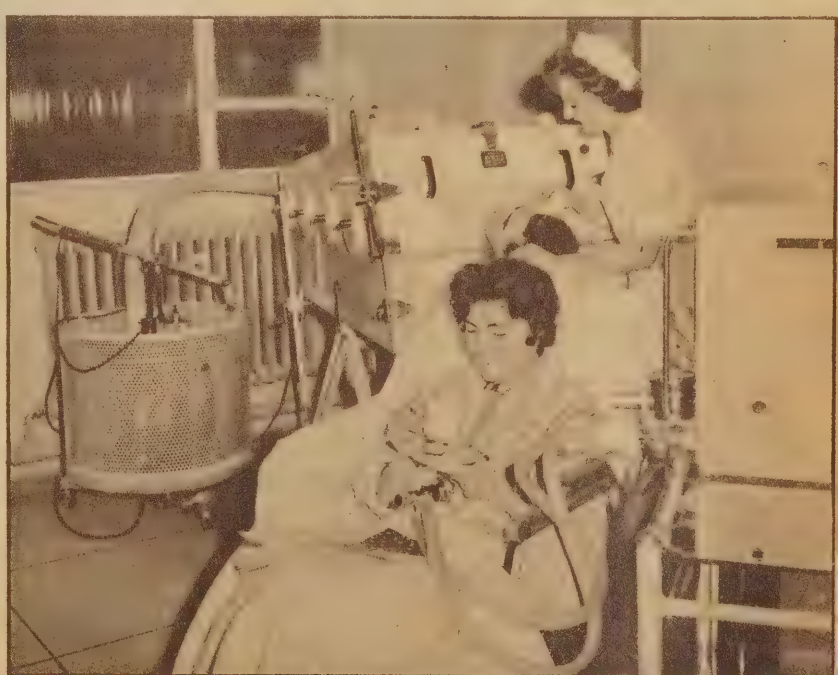
In addition to polio cases, the machine can be used for almost all respiratory cases, including gas poisoning, drowning, chronic bronchitis, post-operative chest conditions and for the administration of anaesthetics. It has been tested on 3,000 cases to date.

Instead of being encased in a box, the patient is linked to the Ventilator by two plastic tubes. Air is delivered to the patient either through a mask over the face, through a tube down the windpipe, or through an incision at the lower end of the throat.

The Barnet Ventilator eliminates the problems of transport involved in the cumbersome iron lung.

Doctors who have tested the machine say that it would have great possibilities in Australia's Flying Doctor Service or as lifesaving equipment on beaches.

The photo shows a polio patient relaxing with a cup of tea and a magazine as a Barnet Ventilator (right) feeds air to her through an incision in the lower part of her throat. In the background is a typical iron lung, which encases all except the head of the patient.



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Pedal plane

BRITAIN is planning to build a man-powered plane.

It will be powered by a propeller driven by a chain from pedals operated by the pilot.

Some of Britain's leading aeronautical engineers are among a group to meet in London to raise the £10,000 needed for the project.

Most of the information needed to start work is already at hand, according to the chief engineer of British European Airways, Mr B. S. Shenstone.

However, the project would not begin until the money had been found.

Britain's attempt was likely to be a fixed-wing aircraft with a propeller, which would be rotated by one or more men using bicycle pedals.

"The use of a flapping wing is the hard way towards man-powered flight," Mr Shenstone said.

"Practically all successful mechanical inventions have gone against nature."

Nevertheless, there was considerable backing for the flapping wing idea. It had been tried in Germany, and one was being built privately in Britain.

One of the main difficulties was to make the frame light enough for a man to lift.

This would be overcome by using wood.

Engineers say drive would be by a flexible bicycle chain, allowing a direct drive from pedals to propeller shaft.

★ ★ ★

Flying TV stations

A DUTCH firm is preparing to transmit television programs from the air.

Its transmitter will operate from a plane circling Holland and West Germany.

The transmission is expected to reach Britain, though few receivers would be able to reproduce the pictures because of the difference between British and Continental standards.

A spokesman of the firm formed to operate the service said in Amsterdam transmission probably would start early in 1960.

The plane would circle at a height of about 26,000ft, transmitting telerecorded programs.

★ ★ ★

Satellite relays

THE cost of a London-New York telephone call could be cut by about 95 per cent under a plan the Administrative Radio Conference discussed in Geneva.

The plan calls for use of "hover-satellites" for telecommunications.

The conference adopted a resolution calling for an extraordinary radio conference to allocate frequencies for all kinds of telecommunications via such satellites.

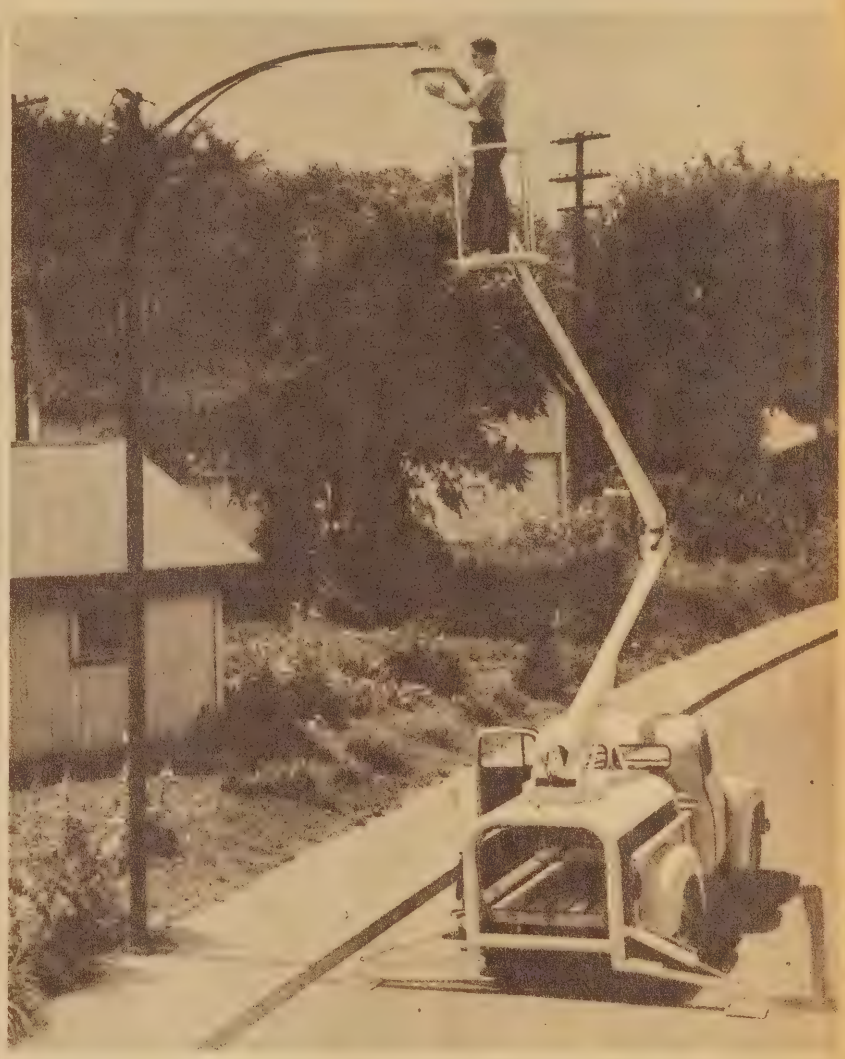
The satellites, which could be used for all kinds of world-wide radio communication, would orbit about 23,000 miles above the earth.

Conference sources said the cost of building and launching each satellite would be about £47 million.

But the volume of traffic would make transmission costs low.

EXTENSIBLE PERSONNEL TOWERS

Many maintenance jobs in the streets of U.S. cities will be simplified by the use of the "extensible personnel towers" pictured below.



KNOWN as "Hi-Rangers" two units are available, designed to place a worker at maximum platform heights of 32ft and 40ft respectively. Maximum working heights are 5 to 6ft above this.

The units are designed for industrial inspection and maintenance, tree culture, street light cleaning and replacement and similar applications. Special heights and weight capacities are available within each series.

The manufacturer states a principle advantage of the new units is their great flexibility in mounting. Series 3 can be mounted on any 3/4 ton (or larger) pickup type truck, utility truck or industrial truck such as the fork lift variety. The Series 4 can be similarly mounted, beginning with 1½ ton truck sizes.

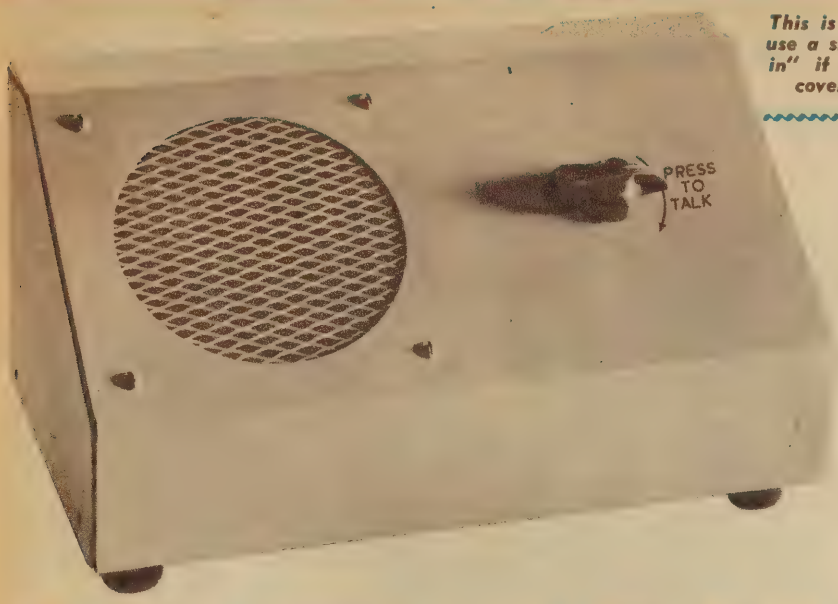
Regardless of the vehicle required, no major alterations need be made before the Series 3 or 4 may be installed. In most cases the vehicle, with mounted Hi-Ranger, may be driven to and from jobs at normal traffic speeds.

Ease of operation and low cost are also cited as advantages. All Hi-Ranger series feature a single-handed "3-D" control, which facilitates safe movement of the operator's platform in any one of, or all, three dimensions simultaneously.

Booms of the new series are constructed of seamless steel tubing, with all power furnished by an hydraulic system powered by the vehicle's engine. Enclosed hydraulic cylinders, which eliminate the need for exposed chains and sprockets, supply moving force for the booms.

Fast acting, retractable hydraulic outriggers provide great stability, and make possible platform weight capacities of 250lbs for the Series 3 and 300 lbs for the Series 4. These capacities can be increased where required.

A safety factor of 600 per cent is incorporated in all structural elements of the new Hi-Ranger series. Where electrical work is to be done, the firm can supply units, the platforms and upper booms of which are insulated with fibreglass.



This is the base station. The remote unit can use a similar cabinet for portability or be "built in" if required. The speaker should not be covered by any acoustically dense material.

Transistorised 2-Unit Intercom

Here is an item for which we have had many enquiries in recent months — a two-unit transistorised intercom. It should be just the thing for many simple office and domestic requirements.

OVER the years we have described several intercommunication systems or intercoms. Some were fairly complicated and others were more straightforward, but they were all quite successful.

While the basic requirements of such systems remain ever constant, the engineering approach to their design changes over the years. The availability of parts, their price, the advent of new types of valves and of transistors all necessitate a fresh evaluation of the problem.

PREVIOUS DESIGNS

In July 1948 we described an eight unit, battery operated intercom using 1K5-G type valves. At the time, these valves were both plentiful and cheap.

However the system required 135 volts of high tension and six volts for the filaments. Such batteries are bulky and by present standards expensive. The newer 1.4 volt peanut series were a better proposition from that point of view and, in the meantime, the idea of a battery-operated intercom had taken on well enough to warrant a fresh examination.

Consequently in May 1949 we featured an improved intercom using the new miniature series of valves. It consisted of 12 units, each with an amplifier using two of type 1T4 and a 3V4 output pentode.

The batteries required were 90 volts for H.T. and 7.5 volts for the filaments and, while the problem of having to replace them at intervals was still with us, it was a better proposition than with the old style valves.

In September 1953 we described a mains operated, simple, two unit intercom suitable for small office or domestic use. It had the one amplifier at the "base" station and a remote unit consisting of a speaker and press-to-talk switch.

We also included instructions for a minor alteration which made the intercom wholly operable from the base end. Thus it could be switched to the listen position so that, for example, proceedings in the nursery could be monitored remotely, without having to trek back and forth personally.

Many other uses for such simple equipment will suggest themselves; passing orders between restaurant dining-room and kitchen or between counter and storeroom, or even for telling "Dad" in his workshop that dinner is ready.

One drawback with a mains operated intercom is that the amplifier must be turned on at all times if instantaneous operation is required. It is possible to leave just the filaments on and switch the H.T. but, over day long periods, the power waste can become considerable, as well as the wear and tear on the valves.

The alternative is to switch the power on and off as required and just wait while the filaments warm up. This could become fairly tedious in many cases but it really depends on the individual need.

And of course it uses an extra valve, the rectifier, together with the power transformer etc. which adds to the cost.

The advent of transistors since then, in quantity and at reasonable prices, has made their use in such equipment an attractive proposition. They are more efficient, the amplifiers are much smaller and the battery requirements are much lighter.

The average battery drain is low when compared to similarly powered valve amplifiers and there is no warm-up period. The transistors are rugged and have a long life expectancy.

The often mentioned instability due to variations in temperature can be controlled by careful design. It is not really as important a point as one might think when considering the use of transistors for normal conditions

A transistorised intercom system was introduced in June 1958 but this was a fairly complex arrangement consisting of twelve separate stations, each one containing its own amplifier and speaker. It was possible for any one station to call and speak to any of the others in the system and up to six different conversations could proceed simultaneously without mutual interruption.

TWO UNIT INTERCOM

It is our intention here, however, to describe a simple two unit transistor intercom similar in scope to the one in September 1953. It has all its facilities and none of the drawbacks.

It is compact, unobtrusive and efficient. It uses one small 9-volt battery and the low average power drain should result in a good battery life expectancy.

The base station can use the same metal cabinet as for the previous intercom. Some of these may still be available on dealers' shelves but, in any case, there should be no difficulty in having a new batch put through if the demand should warrant it.

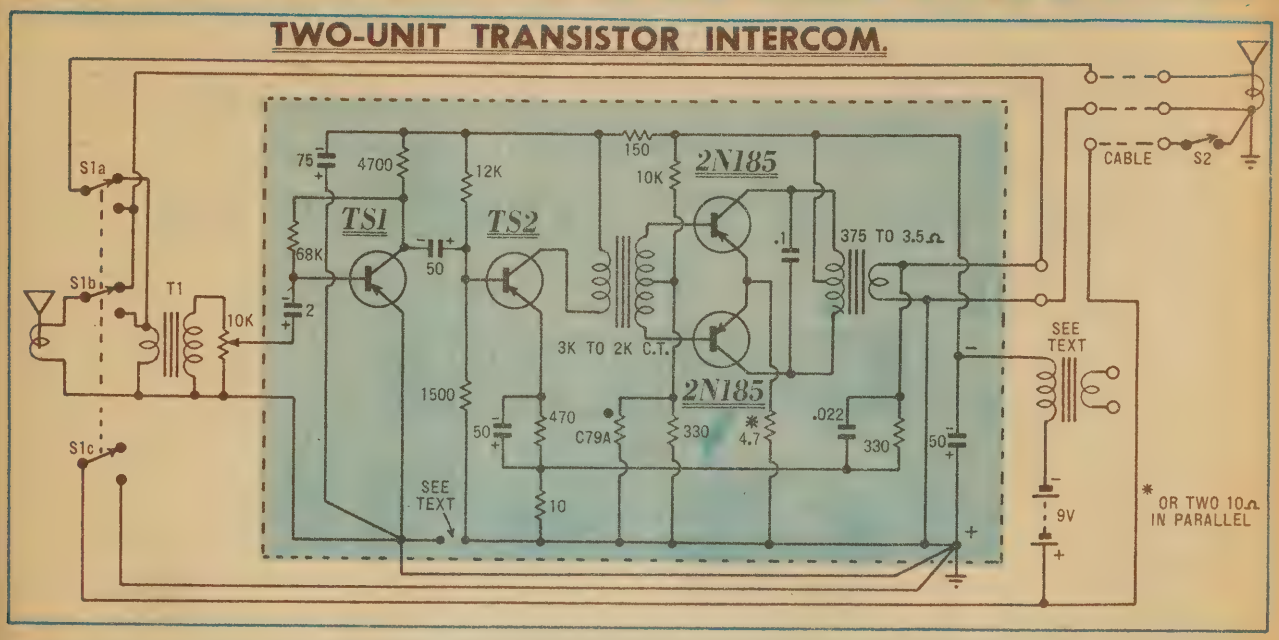
The remote unit contains only a speaker and switch and may be housed either in a matching cabinet or in a shortened version of it, as indicated.

We suggest, however, that some outlet for the back-pressure be provided in the boxes. This could be done by drill-

By John Barker

SYSTEM USES STANDARD PRINTED AUDIO BOARD

TWO-UNIT TRANSISTOR INTERCOM.



The portion within the dotted outline is our standard audio board with the slight modification described in the text. Printed circuits and small components reduce the overall size. If desired, the transistors can be replaced by types OC70, OC71 and two OC72's.

ing a liberal pattern of holes in the back or else, as we did, make a cutout 2½ x 6½ inches and cover it with expanded aluminium.

For the amplifier we have suggested using the audio board from the "Transporta" series of portable transistor receivers. They are excellent for the purpose and newcomers to the art will find them easy to use.

A fairly full description of their assembly was given with the Transporta article, together with photographs, in the August 1958 issue. However, a few hints here would not go amiss, particularly if you missed out on the earlier article.

AUDIO BOARDS

The trend with these boards is to miniaturisation, so that some care is necessary to avoid overheating the components. Some form of "heat sink" is a good idea unless you are a practiced and fast solderer. The best way is to hold the pigtail with a pair of pliers between the component and the point to be soldered. This procedure is a must for the transistors.

There is no point in cramming the components hard against the board, because it may involve making the leads unnecessarily short or bending them sharply close to the component in question.

Mount the two transformers first, then all the small components, making sure that the electrolytic capacitors are the right way round. Their polarities are marked on the circuit diagram. Push the component leads through the holes in the board and snip off the excess leaving about 1/16in to bend over. You can mount them all this way and solder as necessary. Resin cored solder is undoubtedly best for the job.

It is often a good idea to cut the pigtails to the required length and to tin the ends before mounting the component. This helps prevent dry joints. Sometimes component leads, which are supposed to be pre-tinned, are very difficult to solder. A rub with fine emery or a scrape with a razor blade usually fixes the trouble. This also prevents the components from getting too hot whilst you are trying to make the solder "take".

There is no point in cutting the transistor leads at all since they are self supporting on the lengths provided, and it will reduce the risk of heat damage. Some spaghetti tubing can be slipped over the exposed leads.

There is a small modification we had to make to the board in order to prevent instability, due to common paths in the earth returns of the preamplifier and the output stages.

The problem arises when the speaker is used as a microphone. Signal frequency currents circulate in the earth section of the amplifier input and, at the same time, the same signal, amplified, is circulating in the earth section of the output stages. If part of the earth system is common to both input and output, feedback, and hence oscillation can result.

On the back of the board the copper strip running around the outside is the common earth for the whole amplifier

PARTS LIST

2 cabinets.
1 base plate, 4 11/16" x 8 7/16"
1 base plate to suit remote cabinet.
2 5in diameter speakers, 3.5 ohm VC.
1 output transformer, 375 ohm CT to 3.5 ohm.
1 driver transformer, 3000 ohms to 2000 ohms CT.
1 input transformer, same as output transformer. see text.
1 printed circuit audio board.
1 choke, same as output transformer, see text.
1 10,000 ohm tab pot.
1 9 volt battery (3276-P or similar).
1 three pole, two position spring loaded switch.
1 one pole, two position spring loaded switch.

TRANSISTORS.
1 TS1, 1 TS2, 2 2N185.
RESISTORS. (All half watt.)
1 68K, 1 4.7K, 1 12K, 1 1.5K.
1 470 ohm, 1 10 ohm, 1 150 ohm.
1 10K, 2 330 ohm, 1 4.7 ohm or 2 10 ohm in parallel.
1 CZ9A Thermistor.

CAPACITORS.
1 75 uF 12 VW electro.
1 2 uF 25 VW electro.
3 50 uF 12 VW electros.
1 0.022 uF 200 V paper.
Hook-up wire, spaghetti tubing, resin cored solder, battery plug, 4 three wire terminal blocks, oddments of expanded aluminium, 1/8" x ½" bolts, nuts, washers, etc.

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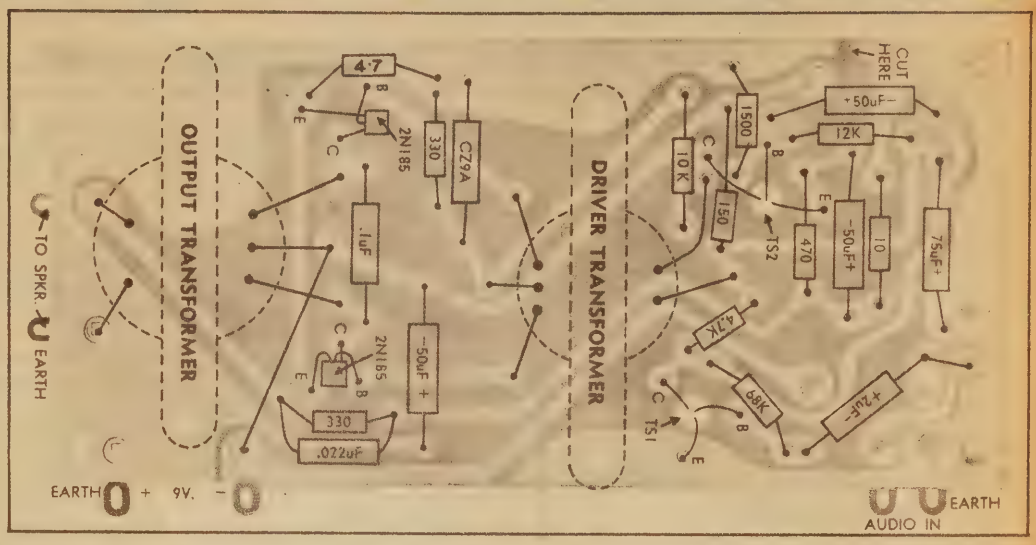
DECK	WALTER MK. I.
HEAD	Twin track Micro Groove CCIR and Continental sensed.
REEL SIZE	5in.
TAPE SPEED	3¾in per second.
RECORDING AND PLAYBACK TIME	600ft Standard Tape — 1 hour — 30 mins. per track. 900ft Long Play Tape — 1½ hours — 45 mins. per track. 1200ft Double Play — 2 hours.
SPEAKER	High Flux 5in speaker.
OUTPUT	2 watts.
OVERALL FREQUENCY RESPONSE	60-7000 cycles per second.
OVERALL DIMENSIONS	11¾in x 11in x 6½in.
WEIGHT	17lbs.

DIAGRAM SHOWS POSITION OF ALL SMALL PARTS

☆

The upper photograph shows the underneath with the components superimposed. The lower is the same board viewed from above. With the aid of these you should have no troubles. If OC72's are used for the output pair their heat sinks can be soldered to the transformer brackets. No other circuit changes will be necessary.

☆



and it is this strip which can cause the trouble.

In order to provide separate earth circuits for the input and output then, we cut this conductor where shown and provided a separate path by way of hook-up wire to the common earth point.

The copper sheet on the boards is very thin and a razor blade will nick out a small piece easily. Any size gap from about 1/16in up will do.

All the earth leads associated with the input are taken to the earthed tag of the input pair and all the output earth leads go to the "plus 9 volts" tag on the board. One lead is then used to join these two earth points.

This is clearly enough illustrated in the circuit diagram.

INPUT TRANSFORMER

The input transformer, T1 in the circuit, is an output transformer with the high impedance winding in the base circuit. The exact impedance ratio is not at all critical, the one we used and which is shown in the photograph happens to have the same specification as the output transformer on the audio board.

Some care is necessary in mounting this transformer so as not to have any coupling between it and the output transformer. If you mount it at the end of the board remote from the output end, as we have, you should not experience any trouble.

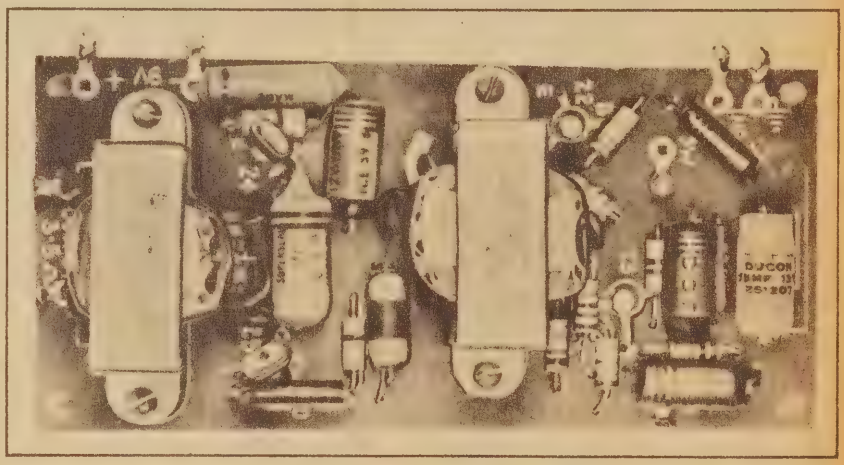
In the base unit all the components bar the speaker and press-to-talk switch are mounted on a base plate which fits into the bottom of the cabinet. The board is mounted vertically next to the battery and the other components are grouped around, as shown in the photograph.

Two small aluminium brackets serve to support the board. One is held by the same bolts as are used for the output transformer, and the other is bolted to the input end through the mounting holes provided.

The foot of the bracket used at the input end will have to be insulated from the base plate to preserve the input isolation. This is best done by widening the holes in the base plate, enough to pass the mounting bolts plus a piece of plastic spaghetti tubing slipped over them, and by placing fibre washers under the bolt heads and nuts.

If the board and the battery are wired with leads just long enough so that they may be lifted out onto the bench without disconnecting them from the rest of the circuit, the unit will be serviced much more easily in the rare event of a breakdown.

The general low impedance of the circuitry in this unit reduces the necessity of running leads by the shortest path as might have been necessary when using valves.



REMOTE UNIT

In the remote unit there is, of course, only the switch and the speaker to be mounted in the cabinet. A tag strip or terminal block is also necessary to anchor the incoming leads. If you wish to control this unit from the base station only, the switch will not be required.

One problem which is common to all intercom systems, transistorised or not, is the effect of resistance of the leads used to connect the various units.

When a speaker is mounted quite close to the output transformer the resistance of the wires connecting them is not significant. Over long runs however, the line resistance can approach and exceed the rated impedance of the speaker voice coil. Then the available output power of the amplifier has to be shared proportionally between the line and the speaker.

REFLECTED RESISTANCE

Also the output transformer reflects a greater resistance in to the primary circuit, which has the effect of increasing the load and reducing the power output. The combination of the two effects can result in a severely reduced speaker volume.

There is a possibility of selecting a different impedance ratio for the output transformer so that the right resistance is reflected to the primary but, as each installation will use a different length of connecting lead, it is better to aim rather at reducing the connecting lead resistance as much as possible.

Consequently the switching has been arranged so that only three conductor cable is required between the base and remote stations. This permits the use of Tough Nylex Sheath power cable with

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4-5F	2	8	0
5C	1	13	6
5CX	1	18	0
5F	2	2	6
5FX	2	5	6
57-H	2	8	0
57-L	3	3	6
6H	2	5	0
6M	2	18	6
69H	2	15	0
69L	3	9	6
8H	2	10	0
8K	2	12	6
8M	3	3	0
8MPA	3	3	0
8MX	4	10	0
10-3G	2	15	0
12K	3	6	0
12M	4	1	0
12MX	6	16	0
12.0	6	0	0
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94B Pattern Generator	162 4 0
110C R.C. Bridge	33 16 0
130A Insulator Tester	30 17 0
171A V.T.V.M.	57 8 0
191A R.C. Oscillator	60 16 6
45C Valve Tester	62 15 9

20B Circuit Analyser	40 6 3
71A Multi-range Meter	26 10 6
72A Multi-range Meter	32 16 0
122A Multi-range Meter	15 5 0
150A Output Power Meter	72 13 0
313D Adaptor	11 1 6
315C H.V. Probe	11 12 0
445 TV Tube	4 8 9
471 HV Probe	11 12 0
477 H.V. Probe	11 12 0
8P 300 M Crystal Probe	5 7 6
VMD 300 Crystal Probe	5 15 0

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twin 1 /.064 conductors and earth wire. This is freely available anywhere and is not too expensive. Its resistance is so small as to be ignored over almost any length likely to be used in practice

If the line is terminated at both ends in terminal blocks, on, say, the skirting boards, a short length of cabtyre power flex can be run to both of the units. The tough nylex is not flexible enough to allow the units to be moved around much.

You could use bell wire or some other conductor which you may have on hand for fairly short runs, then if the volume is inadequate, the position could be improved by running the leads in parallel.

VOLUME CONTROL

The volume control is a Tab pot screwed to the base plate over a ¼in hole thus making it accessable for screwdriver adjustment. These Tab pots were developed for TV use where there is a large demand for semi-permanently adjusted potentionmeters. They are smaller and cheaper than the conventional types.

To realise the full advantages of using transistors it is necessary that the amplifier be switched on only when required, that is each time the press-to-talk switch is actuated. This means that when the remote station is speaking, his speaker is acting as a microphone and the battery positive is earthed so the amplifier is turned on from his end. This is obvious from the circuit diagram.

Now the output transistors are operated in class B for improved efficiency but this means that the average level of the current from the battery will be varying proportionally with the output power. This variation in current becomes a correspondingly varying voltage distributed over the length of the lead used to switch the amplifier on remotely. The amplitude of this voltage depends on the resistance of the leads.

The varying voltage is effectively in series with the voltage generated in the voice coil of the speaker because they both share the common earth lead and the two are duly amplified. The amplification of this varying voltage results in a correspondingly increased variation in the current drawn. This sets the process going again and the result is active audio oscillation.

SEPARATE EARTH LEADS

Even if we used an extra lead to separate the two earth returns, there would still be some magnetic coupling between the two circuits over a long run and, in any case, the advantage would be lost of needing only three conductors.

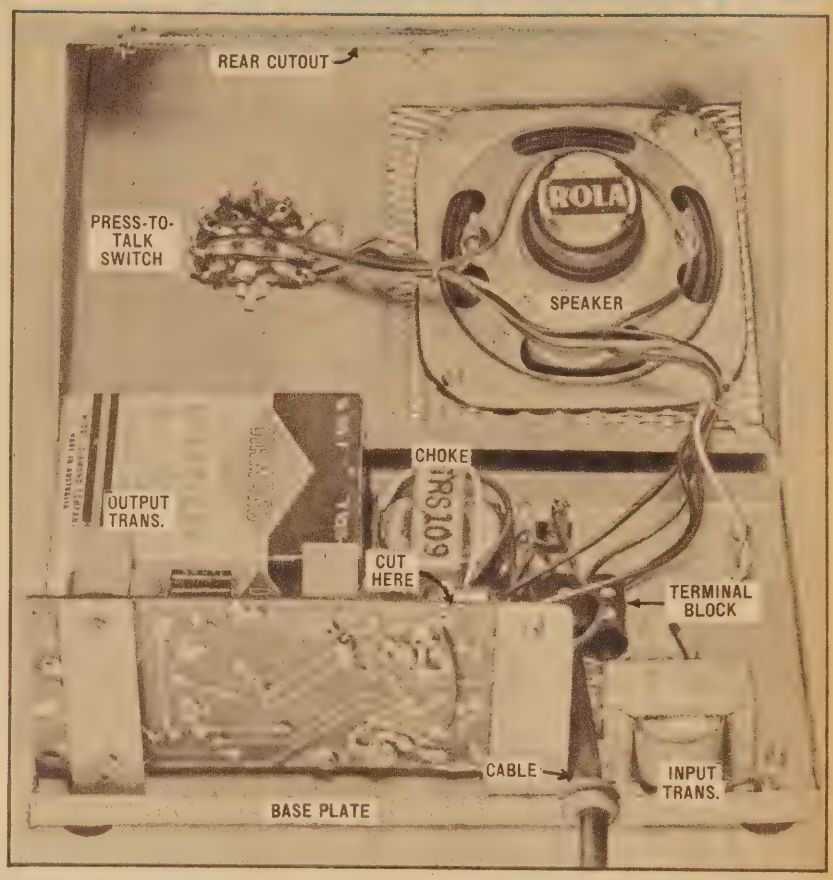
Thus we have introduced the choke between the battery negative terminal and the minus 9-volt tag on the board. This choke must have high inductance and low D.C. resistance.

Its A.C. impedance, however, should be high compared with that of the 50 microfarad capacitator across the battery tags on the board. Connected in this fashion it tends to smooth out the current variation producing the oscillation without impeding the class B action of the output stage.

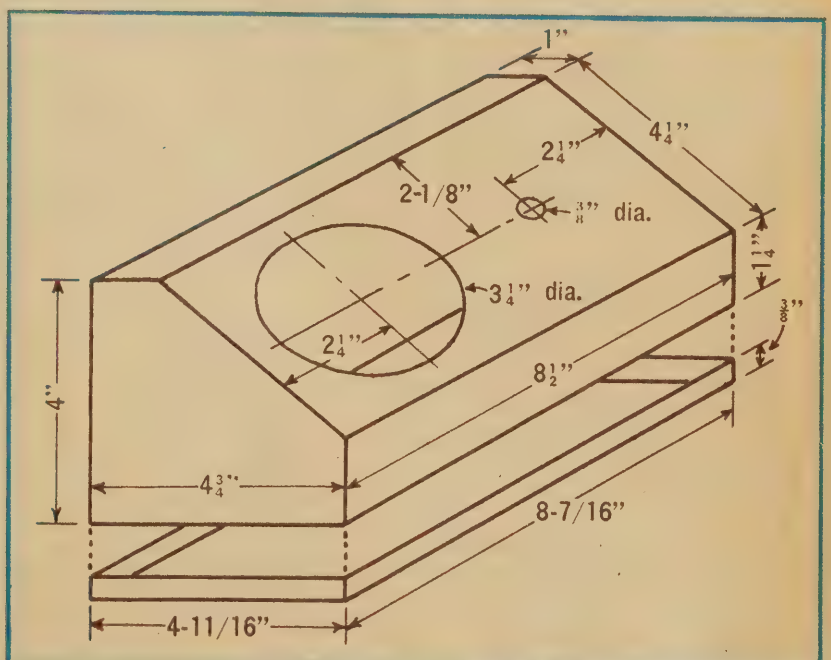
A transistor output transformer of the same specifications as the one in the amplifier will serve the purpose admirably if you use the full primary winding for the choke and curl the other

(Continued on Page 111)

LAYOUT OF INTERIOR OF CASE



Here is the layout inside the case. Length of leads is not too critical. The right hand board bracket is insulated from the base plate. If size is not important a larger, more sensitive speaker may be used in a correspondingly bigger case.



These are suggested dimensions for the case. The remote unit could have the same dimensions in all but the base width (8½") which need only be 4½in. The press-to-talk switch then could go under the speaker.

STACKING TELEVISION AERIALS

In difficult signal areas, some benefit can often be obtained by stacking aerials—provided they are interconnected correctly. This article indicates some of the factors which have to be considered when so doing.

By W. H. Buchsbaum *

WHENEVER the signal obtained from one antenna proves insufficient, the possibility of using two antennas immediately suggests itself. It is generally understood that the spacing and connections of two or more antennas must be arranged in a certain way to get stronger signals.

Most of our readers also know that two antennas do not give simply twice as much signal. As a matter of fact, the theoretical maximum from two antennas is considered to be 1.56 times the (voltage) signal strength from a single antenna, or 3.86 db.

MUTUAL EFFECT

Whenever two antennas are brought near each other, they will affect each other's impedance and pickup characteristics as well. As they are spaced farther apart, this interaction will be less.

However, if they are spaced too far apart, it becomes difficult to connect them together properly, and losses in the connecting lines eventually nullify any advantage of using two antennas.

The simplest case of stacking involves the use of two identical antennas, spaced one above the other and connected by quarter wavelength matching stubs, as shown in Fig. 1A.

Although half-wave dipoles are shown here, all of the data applies just as well to the stacking of yagis, conicals, or any other antennas types.

Every antenna configuration has a characteristic impedance which is made up of a variety of different factors such as radiation resistance, inter-element mutual impedance, and others. For our purposes, only the sum total—the characteristic impedance at the antenna terminals—is important.

In the example of Fig. 1, this characteristic antenna impedance is called R1 for the upper and R2 for the lower antenna. In the case of simple dipoles, this would be about 73 ohms for each; but most TV antennas tend toward a 300-ohm characteristic impedance.

Before any stacking arrangements are considered, this impedance must be known: manufacturer's data sheets should be consulted if any doubt exists.

The second impedance that must be known is the characteristic impedance of the transmission line. For most TV installations, conventional 300-ohm twin-lead is used.

Fig. 1B shows the electrical equivalent of the antenna stacking arrangement of Fig. 1A. Each antenna is represented as a voltage source and a resistance (R1 and R2) and each quarter wavelength matching stub is shown as a transformer. The primary of each transformer is connected to the antenna impedance. The two secondaries are connected in parallel to the terminals (T1) of the transmission line.

TRANSMISSION LINE

We know that the impedance looking into the transmission line at T1 should be 300 ohms. Therefore, the impedance looking out of each matching-stub transformer must be 600 ohms, so that the parallel combination is correct.

Fig. 2 shows the configuration of a matching stub that is one-quarter wavelength long. The same operation is obtained with 3/4, 5/4, etc. wavelengths —any odd multiple of a quarter wave.

At one end is the antenna impedance R1 and at the other the desired impedance RT, which should be connected across the transmission line.

If we assume that we wish to match two 300-ohm TV antennas to a 300-ohm transmission line — a usual case — then each matching stub must transform the 300-ohm antenna impedance R1 into a 600-ohm impedance RT.

This is accomplished by making the characteristic impedance of the matching stub itself a value between the 300- and the 600-ohm end impedances. To be precise, the matching-stub impedance Ro must be the square root of the product of the two end impedances, as shown by the first formula in Fig. 2. For our example, this turns out to be 424 ohms.

Just as the characteristic impedance of a parallel-wire transmission line is determined by the diameter of the conductors and their spacing, so is the matching-stub impedance.

RELATIONSHIP

This relationship is given by the second formula for Ro shown in Fig. 2. For this example, Ro is 424 ohms. This must therefore equal 276 log 2D/d where D is the centre-to-centre separation and d is the diameter of each conductor.

The larger the diameter of conductors used, the greater will be the required separation D to obtain a given impedance for Ro. Conversely, the lower the impedance Ro, the closer the two conductors would be for a given tubing diameter.

Since available wire or tubing would be used to make up the stub, Ro and d would be known at the start, and the formula would be solved for D, the separation between conductors.

The wavelength in free air also applies approximately for matching stubs and antenna separations. However, if stubs are made from insulated twin lead wavelength measurements become substantially shorter.

Any insulating material, such as polyethylene, slows radio waves down; therefore, the wavelength will be shorter than in free space. For simplicity, then stacking bars should be made up of bare rods or tubing.

AERIAL SPACING

In Fig. 1A it appears as if the spacing S between antennas is less than a half wavelength. Actually, appreciable spacings up to a half wavelength will increase the signal strength. The maximum gain possible with good impedance matching is shown in Fig. 1C for various spacing values. Note that half-wave spacing gives the best gain.

To illustrate how two typical 300-ohm antennas can be stacked to give up to an additional 3.86 db of gain, consider the case where it is desired to improve reception on channel 4. (Since

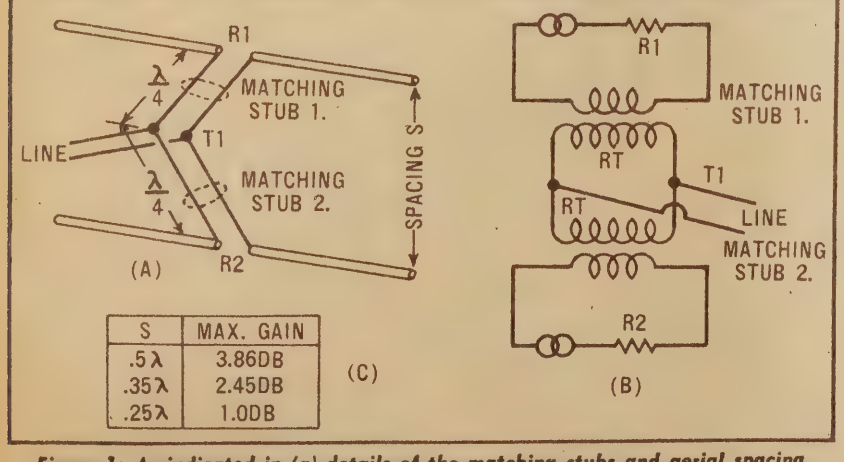


Figure 1: As indicated in (a) details of the matching stubs and aerial spacing are important. (b) Shows the equivalent circuit for two stacked units and (c) the relationship between aerial spacing and gain.

** From "Electronics World"*

matching elements are resonant affairs, good broadband operation becomes less feasible as antennas are stacked. (More will be said about this later.)

We must first determine what a quarter wavelength is for channel 4. A wavelength in free air is determined by the formula 984/f, where f is the frequency in megacycles and wavelength is in feet.

Since the metal bars of which the matching transformers will be constructed reduce wavelength to some extent, a better formula to use, which will take the reduction into account with sufficient accuracy for most cases, is 936/f. The formula for a quarter wavelength, then, is 234/f. The mid-frequency of the channel-4 bandwidth (66-72 Mc) is 69 Mc. Thus 234/69 is 3.4 feet.

Having thus determined the length of the two parallel metal rods or wires, we must decide how far apart they must be spaced to obtain the desired impedance match. Let us assume that metal rods with a cross-sectional diameter (d) of half an inch are being used. R1 and R2 are each 300 ohms.

IMPEDANCE MATCH

The impedance of the line is also 300 ohms. Therefore RT must be 600 ohms, since 600 in parallel with 600 is 300 ohms, which is the line impedance we wish to match. Thus, from the first formula in Fig. 2, the impedance of the stub (Ro) must be the square root of 600 x 300. This is 424 ohms.

With Ro and d known (½in diameter tubing is assumed), we can solve the second formula for the spacing (D) between the centres of the two conductors. This comes out to 8.58 inches. Log tables or the log scales of a slide-rule can be used.

For those who wish to avoid encounters with logarithms, the spacing just worked out will cover that multitude of cases where 300-ohm antennas are being matched to 300-ohm lines; i.e., where the matching impedance Ro is equal to 424 ohms.

Where R1 and R2 are 72 ohms and RT is 600 ohms, as is the case with other antennas, Ro is 208 ohms. To obtain this impedance, spacing D should be 1.42 inches.

Since there should be no particular problem in working out Ro for any application, spacing D, using ¼-inch diameter tubing, is given for several values of Ro: for 200 ohms, 1.3 inches; for 300 ohms, 3 inches; for 400 ohms, 7 inches. If 3/8-inch tubing is used, D will be: for 200 ohms, 1 inch; for 300 ohms, 2.3 inches; for 400 ohms, 5.5 inches.

TYPICAL FIGURES

Coming back to our attempt to obtain maximum gain for channel 4, we now have the elements we need to stack two antennas. Length for each quarter-wave bar is 3.4 feet. As for spacing S between the antennas: at best they should be half a wave apart. The free-air half-wave spacing is 7.1 feet. However, the combined length of the two 3.4-foot quarter-wave sections is only 6.8 feet.

Since this discrepancy represents an error of less than 6 per cent, reducing the spacing between antennas by this small amount to accommodate the size of the stubs will not produce any significant loss of efficiency.

If every last drop of gain is considered important, each length of tubing in the stub can be made ¼ of a wave-

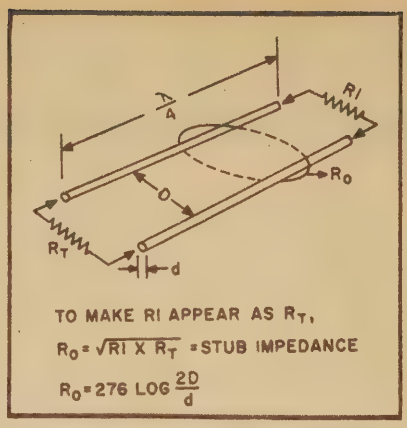


Figure 2: Critical values in matching stubs and formulas for deriving them.

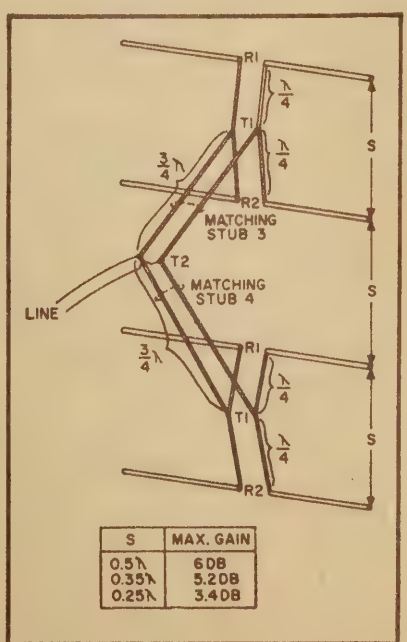
length, and the stubs can be connected at an angle, as shown in Fig. 1A. If the small compromise is tolerable, however, two lengths of 6.8-foot tubing can be used between the two antennas and the antenna line can be connected at their midpoints.

When the signal from two antennas is still too weak, the obvious solution would be to add a third one. In actual practice, the use of three antennas is rare, but four can be matched conveniently and with good results.

FOUR AERIALS

The most widely used method of stacking, and also the simplest, is shown in Fig. 3. Here we have doubled up on the two antennas shown in Fig. 1 and, as shown in the table of Fig. 3, the gain increase is again less than double. Where two antennas with half-wave spacing give 3.86 db, four antennas give 6 db. Again a reduction in spacing results in less gain.

The impedance matching problem is



S	MAX. GAIN
0.5λ	6DB
0.35λ	5.2DB
0.25λ	3.4DB

Figure 3: Development of the matching network for an array of four antennas.

treated here in the same way as for the double stack. Consider first the impedance which should appear at the transmission-line terminals T2 in Fig. 3. To get 300 ohms at this point, each set of matching stubs 3 and 4 must present 600 ohms; but we have shown in Fig. 1 that the impedance which is present at each set of terminal points marked T1 is 300 ohms. As was demonstrated for the double stack, the matching stub to transform 300 ohms into 600 must have a characteristic impedance of 424 ohms itself. We have shown how this matching-stub impedance is determined by the diameter and spacing of the conductors.

In other words, the same matching-stub impedance can be used for stubs 1, 2, 3, and 4. The difference between the primary stubs (1 and 2) and the secondary stubs (3 and 4) is that the latter could not possibly be a quarter wavelength long since the separation between the connecting points will be about a half wave long.

QUARTER-WAVELENGTHS

A half-wavelength line does not provide the desired impedance transformation. It is thus necessary to make each of the secondary stubs 3 and 4 three-quarters wavelength long. The extra length can be taken care of by bending the bars themselves or by bringing them back toward the antenna supporting mast.

It is possible to use other systems for devising the stubs, including one in which half-wave elements are used. However, determination of values becomes more involved, and the values for D and d become such that special construction requirements must be considered.

Whenever antennas are stacked for additional gain, the accompanying changes in bandwidth and directivity cannot be neglected. These side effects may be helpful in some locations but in others they can be harmful.

One important result of stacking is the reduction in antenna bandwidth.

Since the matching stubs must be designed for a single frequency, optimum impedance match really is limited to a relatively narrow frequency band. As the impedance match gets worse above and below the design frequency, reflections occur which reduce signal strength and can even cause ghosts to appear.

EFFECT ON BANDWIDTH

The more antennas that are stacked together, the greater will be the bandwidth reduction. As a general rule, it is safe to say that a given antenna which has uniform gain over the low TV band will have good gain only over a single channel when four such antennas are stacked.

In the case of the high TV band and the u.h.f. band, the percentage of bandwidth reduction is the same. However, since each channel occupies a smaller percentage of the carrier frequency, the apparent bandwidth reduction due to stacking is less pronounced.

It is most likely that stacking will have some minor effect on the horizontal field pattern, making it desirable to check orientation. It will certainly produce a pronounced narrowing of the vertical lobe and it would be wise to check the tilt of the system for maximum performance.

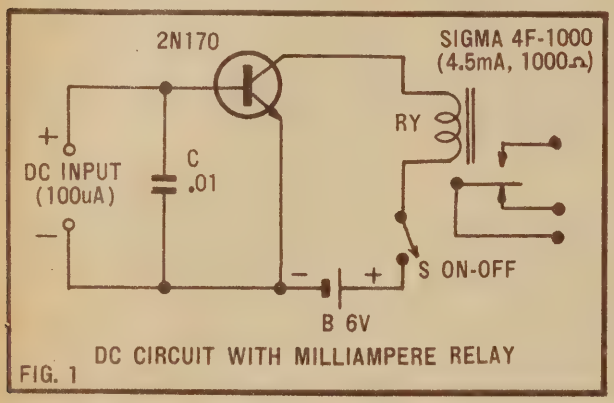
TRANSISTORISED RELAY CIRCUITS

The following article, prepared by Engineers of the Aerovox Corporation, contains interesting ideas on the association of transistors with relay switching circuits. Many of the components mentioned may not be directly available in this country but their type numbers have been retained in the text to help possible identification of equivalent units.

SENSITIVE D.C. relays which operate on control currents of a few microamperes usually are of the D'Arsonval (rotating-coil, meter-movement) type. Their construction is similar to that of a microammeter.

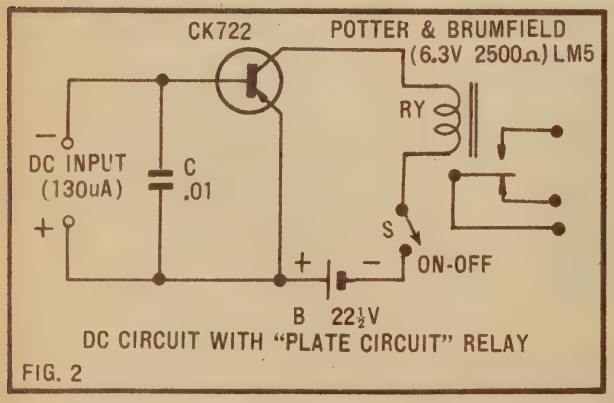
They are high-priced, often delicate, and sometimes depend upon a permanent-magnetic stationary contact to pull the moving contact "home," thus making a reset operation necessary to open the contacts.

Formerly, the only way to sensitise a more rugged, less expensive relay so that it could be operated on tiny currents was to precede it with a valve-type D.C. amplifier. But this necessitated a power supply for plate and filament voltages and the resulting standby-current (and power) requirement had to be taken into account.



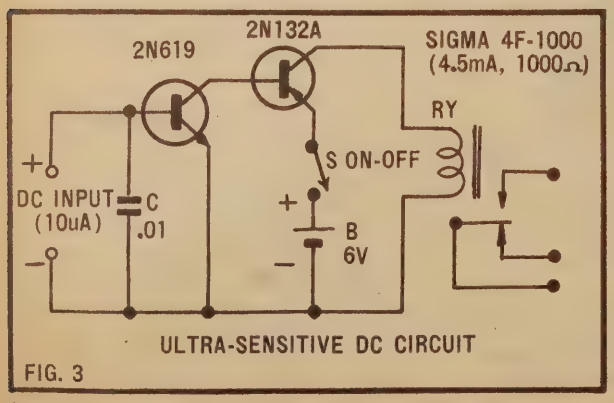
DC CIRCUIT WITH MILLIAMPERE RELAY

FIG. 1



DC CIRCUIT WITH "PLATE CIRCUIT" RELAY

FIG. 2



ULTRA-SENSITIVE DC CIRCUIT

FIG. 3

Furthermore, the reliability of such a combination is poor, because of tube and power failures. Battery power could not be employed economically.

The transistor has removed many of the problems of relay sensitising. Since the transistor basically is a current amplifier, it is readily applied to D.C. relay circuits.

Its standby power requirements are negligible and it can be operated economically from a single small, inexpensive battery. Its life is unlimited, its circuitry simple, it is ready for fast operaton (requiring no warmup whatever) and the amplifiers in which it is used may be made small and compact.

This article describes a number of circuits for transistorised relays. Complete operating data are given so that the reader can set up any one of the circuits at will.

These arrangements do not exhaust the possibilities, but are typical of certain classes of applications. In addition to being useful, as shown, they will suggest other modes of use.

Figures 1 to 6 illustrate basic amplifier-type D.C. relay circuits. In each of these arrangements, direct current amplification is provided by a transistorised circuit ahead of the mechanical relay. (Figure 6 dispenses with the relay.)

The variety of circuits given will enable the designer or technician to select the one best suited to an individual application.

The common-emitter configuration is employed in each instance, for maximum current gain. The specified operation current and input resistance will vary somewhat with individual transistors.

SINGLE TRANSISTOR CIRCUIT

Figure 1 shows a simple, single-transistor circuit employing an inexpensive N.P.N. transistor (2N170). An input current of 100 microamperes will close the relay. The latter is a 1,000-ohm, 4.5-milliampere unit. (Sigma 4F-1,000).

The input resistance of the amplifier is approximately 5,000 ohms. Bypass capacitor C serves to remove any A.C. or R.F. component which may be present in the input current.

Standby current from the 6-volt battery, B, when Switch S is closed but no input current is applied to the circuit is 60 microamperes. If a CK574 transistor is substituted for the 2N170, an input current of only 20 microamperes will close the relay.

However, the CK754 is a P.N.P. unit and its use will require reversing the polarity of Battery B and the two D.C. input terminals.

Figure 2 shows a similar circuit for operation of a somewhat heavier, tube-plate-type relay. Here, RY is a 6.3-mA, 2,500-ohm unit (Potter and Brumfield LM5). Some designers will have such relays on hand from previous vacuum-tube systems. An inexpensive P.N.P. transistor (CK722) is employed.

The relay will close with an amplifier input current of 130 microamperes. The input resistance of the amplifier is approximately 4,000 ohms. Standby current from the 22½-volt battery, B, when Switch S is closed but no input current is applied to the circuit, is 72 microamperes.

The ultra-sensitive circuit in Figure 3 is recommended for operation at very low current levels. Here, a 2-stage direct-coupled amplifier supplies the high gain needed to close the 4.5-mA, 1,000-ohm relay, RY (Sigma 4F-1,000), from an input current of only 10 microamperes.

Standby current from the 6-volt battery, B, is of the order of 100 microamperes. The N.P.N. input transistor (2N619) receives its positive collector voltage from Battery B through the internal base-emitter path of the P.N.P. output transistor (2N132A).

The collector output current of the 2N169 therefore flows through the base-emitter path of the 2N132A, this arrangement requiring no coupling resistors.

It is clear that the zero-signal static collector current of the 2N619 likewise flows through the input path of the

2N132A and, being amplified by the second transistor, will raise the static current flowing through the relay.

For this reason, a silicon transistor is specified for the input stage because of the extremely low leakage current of such a transistor and the good high-temperature characteristics of this unit.

This is done with full realisation that silicon transistors at present are high-priced (the 2N619 costing about five times the price of 2N132A). However, there is no alternative if the simplicity and compactness of this high-gain, direct-coupled amplifier are to be obtained.

Figure 4 shows the circuit of a power-transistor amplifier for operating a heavy relay, RY (Advance PG/2C/6VD). The latter is a 6-volt, 16-ohm unit requiring approximately 0.4 ampere for closure. The relay contacts will handle 15 amperes at 115 volts. An input current of only 20 milliamperes D.C. will actuate the relay.

Standby current from the 9-volt battery, B, is approximately 1.5 milliamperes. The input resistance of the amplifier is approximately 1 ohm.

HEAT SINK ESSENTIAL

The power transistor (2N255) must be operated with a suitable heat sink, for safe dissipation of the power of approximately 2½ watts. Assuming that the relay contacts will switch the full, maximum-rated current of 15 amperes, this relay circuit will provide an overall current gain of approximately 750.

When the current sensitivity (20 mA) of the high-power circuit must be increased, a low-level amplifier stage may be added, as shown in Figure 5.

Unlike the arrangement given in Figure 3, however, a silicon transistor is not needed in the input stage, since normal leakage current drift in the 2N78 germanium input transistor will not result in sufficient increase in the relay standby current to be detrimental.

An input current of only 2 mA to the input transistor (2N78) will result in relay closure. The relay is an Advance PG/2C/6VD unit requiring approximately 0.4 amperes of closing current.

Standby current from the nine-volt battery, B, is 3 milliamperes in the absence of an input signal. Capacitor C serves to remove any AC or RF component which may be present in the input current.

Assuming that the relay contacts will switch the full, maximum rated current of 15 amperes, this relay circuit will provide an overall current gain of approximately 7500. In order to handle safely the power involved, the 2N255 power transistor must be provided with a suitable heat sink.

In the two-stage circuit shown in Figure 6, the mechanical relay has been omitted entirely, the output power transistor (2N255) switching current in the load directly through its collector circuit. This arrangement will be suitable for use with load devices (such as heaters, solenoids, lamps, signal alarms, etc.) of resistance not exceeding 1 ohm. At higher load resistances, the output current change decreases.

An input current of only 2 milliamperes to the 2N170 transistor will produce a current flow of 1 ampere, through the load. Standby current from the 6-volt battery, B, is approximately 3 milliamperes. In order to handle safely the power involved, the 2N255 transistor must be provided with a suitable heat sink.

DIRECT COUPLED CIRCUIT

As in the circuits given in Figures 3 and 5, a direct-coupled arrangement is employed here, with the collector current change of the input transistor flowing through the internal base-emitter path of the output transistor directly.

However, a silicon input transistor is not required (as was the case in Figure 3) since the amplification of the 2N170 leakage current by the 2N255 does not result in enough current to be significant in the external load, in most instances.

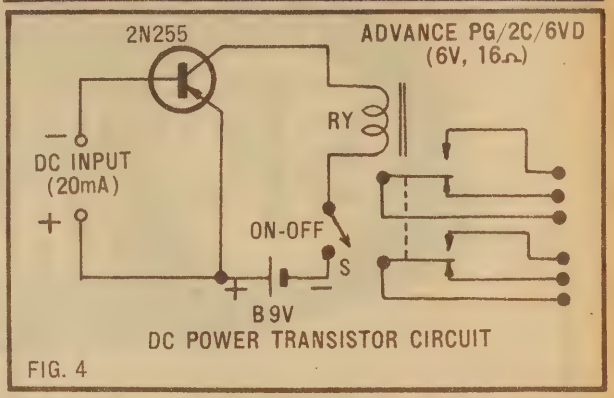
Where heavier load currents are to be switched, a larger transistor than the 2N255 may be used. Contemporary high-power transistors handle collector currents up to 15 amperes or more.

The amplifier-relay circuit as shown in Figures 1, 2 and 3 may be adapted to AC and RF use by connecting suitable rectifiers ahead of them. This is comparable to the process of rectifying AC for operation of a DC meter.

Figure 7 shows several circuits for accomplishing this conversion. In Figure 7 (A) a general-purpose germanium diode, D, is connected in series with the input transistor, V, of the relay amplifier circuit. The diode is poled here to supply a negative output to the base of the PNP transistor.

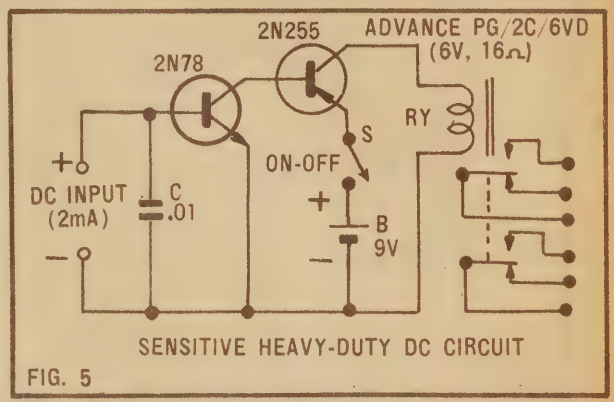
If the input transistor is an NPN type, the diode must be reversed to supply a positive output to the base.

TYPICAL RELAY SYSTEMS



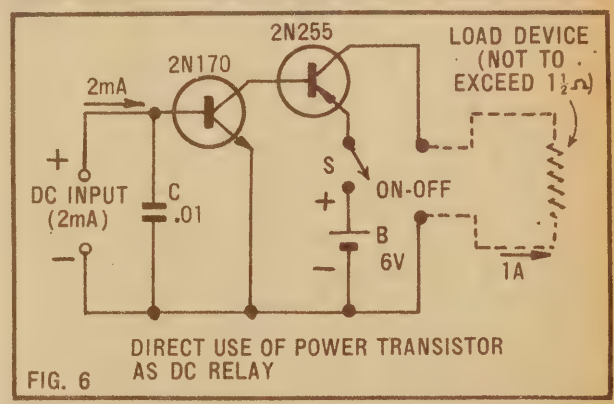
DC POWER TRANSISTOR CIRCUIT

FIG. 4



SENSITIVE HEAVY-DUTY DC CIRCUIT

FIG. 5



DIRECT USE OF POWER TRANSISTOR AS DC RELAY

FIG. 6

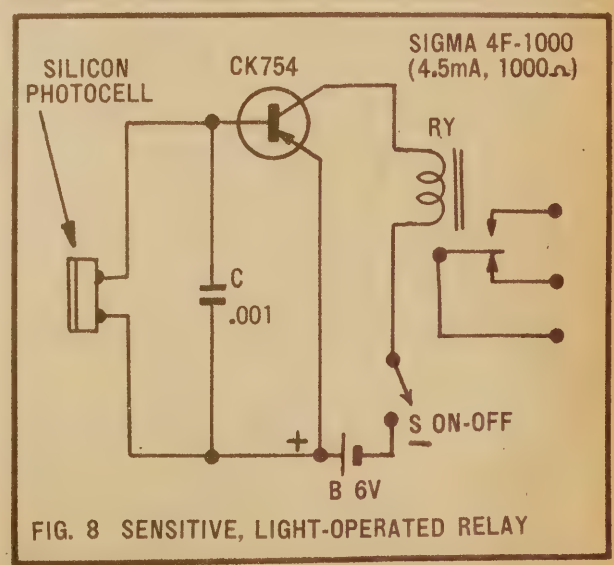
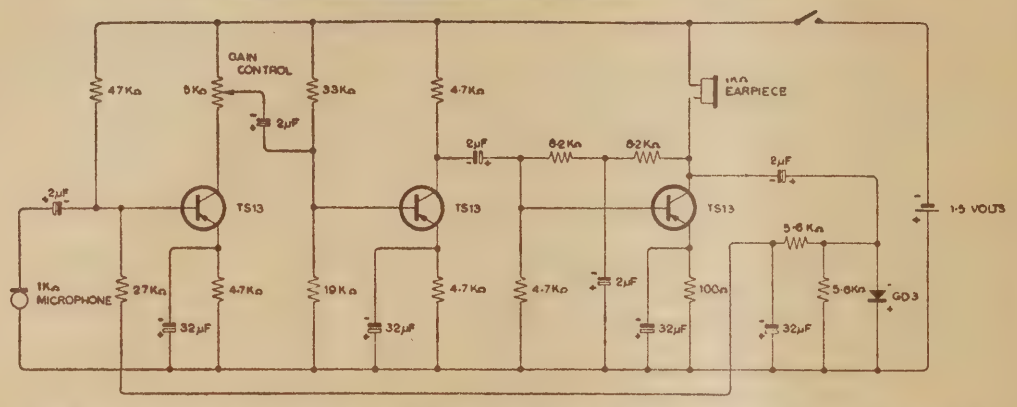


FIG. 8 SENSITIVE, LIGHT-OPERATED RELAY

STC SETS THE STANDARD FOR TRANSISTORS



TRANSISTOR HEARING AID UNIT

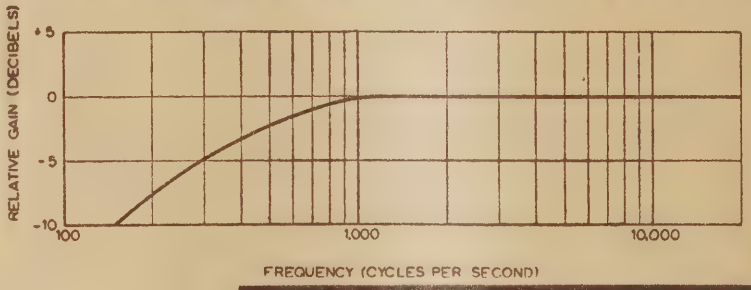
The circuit diagram above shows a transistor hearing aid unit capable of very good performance, although of simple design.

It is intended for use with an earpiece and microphone of the magnetic type, both of which are readily available. The absence of iron-cored transformers enables the unit to be of very small physical size.

The voltage gain is approximately 45 dB. with a supply voltage of 1.5 volts, which is generally adequate; it can be increased to approximately 54 dB. by using a supply of 3 volts. The current drain at 1.5 volts is 3.5 milliamperes. If even greater gain is required, an additional transistor can be added.

The frequency response of the amplifier itself is shown in the accompanying curve; the response of the entire unit will depend also upon the characteristics of the microphone and earpiece.

The audio frequency output voltage is rectified by means of a germanium diode, filtered and applied to the base of the first transistor to operate as an automatic gain control system.



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M182D

The simple circuit just described is satisfactory only when there is no DC component in the AC or RF signal. Such direct current reaching the input transistor would cause a spurious signal in the amplifier output circuit and might erroneously close the relay.

The circuit shown in Figure 7 (B) provides DC isolation by means of the blocking capacitor, C. In this instance, however, an additional diode, D2, is required for the reverse half-cycle of the signal component.

The two diodes, D1 and D2, are shown as a unit within dotted lines and designated RECT, for the reason that 2-unit meter rectifiers are obtainable in this configuration and are useful efficiently up to about 5 KC.

For higher-frequency operation, a pair of general-purpose germanium diodes should be connected as shown in Figure 7(B). The diodes are poled in this illustration to that the DC output is positive to the base of the NPN input transistor, V, of the relay amplifier. If, instead, a PNP transistor is employed, both diodes must be reversed to supply a negative output to the base.

RF TUNING CIRCUIT

Figure 7 (C) shows an RF circuit for tuning-in a desired RF signal which is to actuate the relay. The inductance of Coil L and the capacitance of Tuning Capacitor C are chosen for resonance at the frequency of desired signal. For impedance matching, the tap to which Diode D is connected is placed between ¼ and 1/3 of the way up from the ground end of the coil.

The diode is poled to deliver a negative DC output to the base of the PNP input transistor, V. If, instead an NPN transistor is employed, the diode must be reversed to supply a positive output to the base.

Another rectifier, not shown here, is the bridge-type. The full bridge employs four rectifiers or diodes and is familiar to most readers.

While the bridge delivers more DC output current than single-element rectifiers, and somewhat more than the 2-element unit shown in Figure 7 (B), its disadvantage is that its input and output circuits cannot be grounded simultaneously. This often introduces many operating difficulties in amplifier-relay circuits such as those shown in Figures 1, 2 and 3.

While a bypass capacitor should be connected across the DC output terminals of each rectifier circuit, it is not shown in Figure 7, since such a capacitor already is present in each of the circuits to which one of these rectifiers might be connected. (See Capacitor C in Figures 1, 2 and 3.)

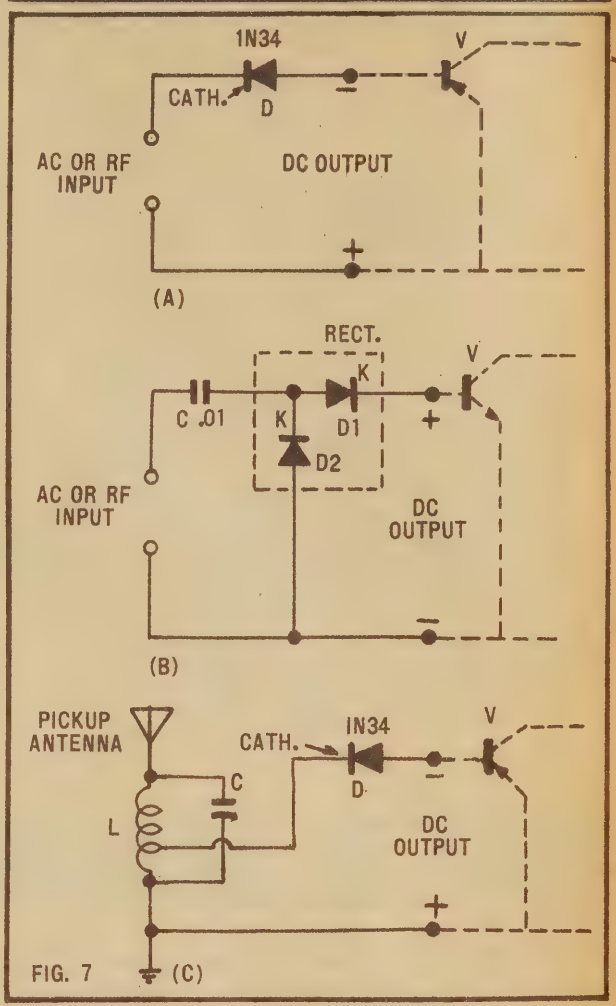
SELF-GENERATING CELL

In Figure 8, the DC input signal for the transistorised amplifier is obtained from an illuminated, self-generating photocell. A silicon photocell (such as International Rectifier Corporation Type Sa5-M or Hoffman S-1A) is employed for high output. Similarly, a high-gain transistor (CK754) is used. (This transistor has a maximum short-circuit current gain, beta, of 300). This combination results in high sensitivity, light from a regulation-size flashlight at a distance of more than 30 feet being sufficient to close the 4.5-mA, 1000-ohm relay, RY (Sigma 4F-1000) in the collector circuit of the single transistor.

Standby current from the 6-volt battery, B, is approximately 200 microamperes when the photocell is darkened.

The practical circuits given in this article show some of the ways of using transistor circuits in relay applications. New

AC, RF INPUT CIRCUITS



semi-conductor devices and circuits will increase the scope of application.

For example, heavy current can be handled by the new solid-state thyratron, a transistor-like power-switching device which might be employed in a circuit of the general type shown in Figure 6.

Another possibility is the use of flip-flop circuits, which have the ability to remain in a conducting state once they are switched-on by a signal pulse and thus simulate electronically the latching relay. Still other possibilities are circuits simulating multipole, multiposition relays but in which the mechanical relay is dispensed with entirely.

A COURSE IN ARCTIC SURVIVAL

STRANGE as it may seem, men lost in the Arctic are more often killed by carbon monoxide than they are by the cold.

The danger comes from building fires in a shelter without providing a way for the smoke and fumes to escape.

This and many other vital lessons are being learned by R.C.A. personnel assigned to man the Ballistic Missile Early Warning System sites at Thule, Greenland, and Clear, Alaska.

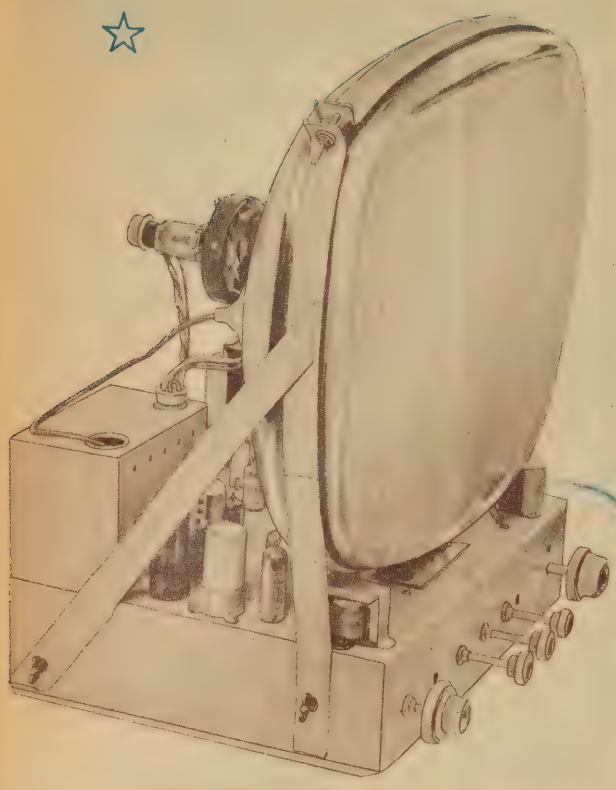
One of the functions of the course is to correct popular misconceptions which sometimes lead to blunders in the Arctic.

For instance, one common misconception is that a man should not allow himself to go to sleep because he will freeze to death. Actually, the course teaches, one of the first rules of the Arctic is not to become exhausted. If a man becomes cold while sleeping, he will awaken—unless he has allowed himself to reach the point of physical exhaustion. If his reaction to cold has been numbed by fatigue, this increases the possibility of freezing to death.

Also, it is popularly thought that in order to stay warm, one should constantly keep moving. However, according to the course unnecessary exertion tires a man faster and causes perspiration. When Arctic clothing is moistened its insulating quality is lost. The number one rule of the Arctic is to keep dry.

In the event of an airplane crash landing, trainees are taught that one of the most important items to salvage is the aircraft's oil. However, if they wait too long the oil will freeze in the engine and will then be unobtainable. They are told to open the oil valves immediately and let the oil drain out on to the snow. When the oil has frozen it can be rolled into a mat and used to burn for heat and for signal fires.

There have been numbers of cases where parties of survivors spent painful weeks under adverse Arctic conditions, when they might have been rescued in hours if they had been careful to salvage available materials for signalling.



Here is one version of our remote control unit shown connected to our 1959 TV Receiver. It provides volume, brightness, muting, and an earphone outlet for private listening. It is suitable for use with all our TV designs, as well as most commercial sets. Other versions, offering alternative facilities, are discussed in the text.

REMOTE CONTROL FOR TV SETS

"Laziness is no good unless it is well carried out." This rather cynical old adage implies that laziness—or relaxation if you prefer the term—is an art to be studied and encouraged for its own sake. If so it is one in which Australians seem to be well to the fore, that is if the popularity of TV remote control devices is any indication.

By Philip Watson

THE reason for such popularity is not hard to find. As a form of relaxation there is nothing quite like a comfortable armchair—one into which you can really sink—soft lighting, and one's favourite TV program; whether it be variety show, drama or documentary. Just a matter of sitting back in complete physical comfort and being entertained.

At least that's the way we like to think of it. In practice, it can be very different. Before the program is many minutes' old it often becomes apparent that the volume setting which was correct for the previous program is no longer so. It is either down by sufficient to make portions of the dialogue inaudible, or up by just sufficient to be annoying. Either way you have to heave yourself out of the comfortable chair in order to reset it.

And no sooner is one resettled comfortably than the station engineer has second thoughts about the original brightness or contrast settings. So it's out of the chair again to make further adjustments. As anyone who has ever experienced it knows, it does not take many such interruptions to completely destroy the atmosphere of relaxation. What set out to be an evening's entertainment becomes a series of petty annoyances for the ultra-lazy man.

To make matters worse, it often is quite difficult to make settings at the receiver which remain correct when one retires to the other side of the room. Volume is one of these, for fairly obvious reasons; while brightness is another. The reason for the latter is not so obvious, but there seems little doubt that a picture which appears correct when close up to the screen will appear darker at the normal viewing distance. For the same reason contrast settings may not always be exactly optimum.

Small wonder then that we wish to take as many of these controls as possible with us to our comfortable armchair. Given such facilities we may not only make our adjustments with far less effort, but also with a good deal more accuracy.

Even in the few years we have had TV in Australia a wide variety of remote control systems have been offered to the public. They range from quite simple systems with one or two controls on the end of a cord, through the ultra-ingenious "wireless" types, to the very complex which provide channel changing and fine tuning facilities as well as volume, contrast, brightness, etc.

While we would not claim that the latter are outside the scope of the home-builder, it must be appreciated that they would call for a lot of skill and ingenuity, to say nothing of components which may not be readily available.

ORDER OF PRIORITY

All things considered, we feel that channel changing—which includes fine tuning—is something we must put at the bottom of the list. After all, it need be done only once for a particular program, at relatively infrequent intervals, and at times when it does not interrupt one's train of thought.

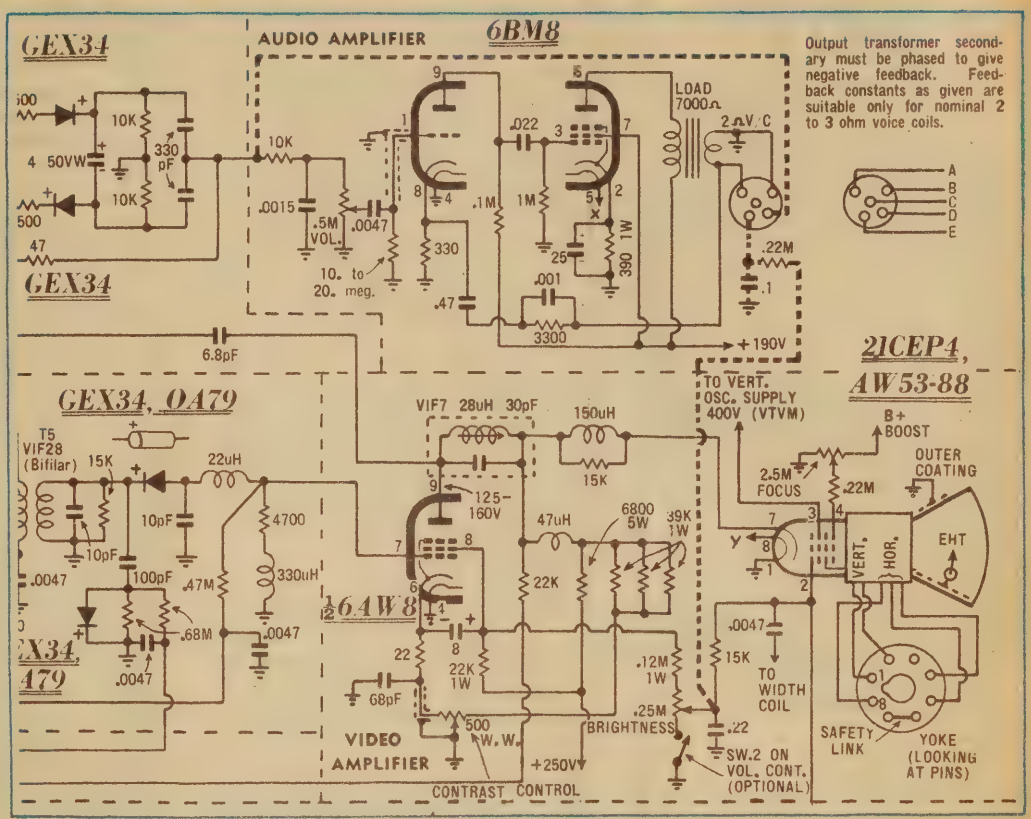
The various forms of "wireless" control are ingenious, but there is some doubt as to whether the presence of a cord is sufficiently irksome to justify all the extra components and complex circuitry involved.

Putting aside these rather fancy schemes, we feel that the average home-builder is mainly interested in providing the more obvious facilities such as volume, brightness and contrast, and has no objection to putting these on the end of a suitable cord. What he may lose in ingenuity he makes up for in economy and simplicity.

Coming to the actual methods which

CHANGES TO MAIN CIRCUIT ARE FEW AND SIMPLE

Here is the relevant section of the 1959 TV Receiver circuit, showing the changes necessary to adapt it for the control unit. These apply equally to our earlier circuits and most commercial sets. Note the 5 pin speaker plug and socket, which provides an extra circuit for contrast control where practicable.



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may be employed to provide these facilities, we find that there are a number of approaches possible in most cases, often depending on the characteristics of the particular receiver circuit. In our case, we may consider systems suitable only for our TV receivers, or those which may be more universal and suitable for use with most receivers.

Of the three facilities, contrast appears to be the most difficult to provide, although, once again, this varies with individual circuits. However, our own observations suggest that this is probably the least important of the three and that even the simplest arrangement, giving volume and brightness control, has so much to offer that it is very well worth while.

As a refinement we may add a muting switch; a switch connected directly in parallel with the volume control so that, when closed, volume is reduced to zero. This is most useful when it is desired to silence the set for brief periods without disturbing the existing volume setting.

This, then, would seem to provide the basis for the simplest worthwhile unit; brightness and volume controls with a muting switch. These can be provided in a manner which is suitable for most receivers, both home-made and commercial, without extensive alterations. Also, they require only a three-wire cable and can usually employ the two spare pins in a standard four-pin speaker socket.

CONTRAST CONTROL

The next step might be the provision of a contrast control, assuming a suitable method is available for the particular circuit. Alternatively, or perhaps in addition to, we may like to provide an earphone outlet on the control unit.

This latter facility may be useful in two ways. One of these is to feed a hearing aid earpiece, and this is a much more satisfactory way of serving the hard of hearing than by running the speaker at an uncomfortably loud level, or even trying to pick up the sound through the regular hearing aid.

The other use is to provide private listening facilities for one or two persons without disturbing the other members of the household. This is most useful when a favourite program occurs during the children's homework period, late at night, or whenever someone else may want to rest or sleep. It is likely to prove invaluable in the home of a shift worker.

SPECIAL UNIT

Fairly obviously our control unit is likely to be become less "universal" as the facilities are increased, becoming more and more a specialised unit, designed for a particular receiver. Also, it will require more than a conventional three-wire cable, at least four and possibly five conductors being necessary if all facilities are required.

For a start, therefore, let us consider our simplest unit, and how the facilities might be provided. While described on the basis of our own TV circuits, most readers will be able to recognise the equivalent sections of other receivers and adapt it to them. Later we will have more to say about the contrast and earphone facilities.

First, the volume control. One of the simplest arrangements is to fit a suitable pot in the voice coil circuit of the loud speaker, making it as simple or elaborate as you please, depending on how fussy you are in regard to impedance matching.

Unfortunately, while it is easy to work out a good circuit on paper, the low impedance of most speakers makes it difficult to provide reliable operation with the conventional wire-wound controls. Contact resistance is the big hazard, often assuming a significant proportion of the total impedance, as well as being quite erratic in nature.

At most other points in the audio system it is difficult to handle the signal without using shielded lead or introducing high frequency losses, due to the signal being at too low a level, too high an impedance, or combination of both.

SHORTED HT

One commercial scheme is progressively to short to chassis the HT supply to the limiter stage in the sound IF system. This sounds drastic, but it isn't really. Such a stage will usually be fed through a 100K resistor from (approximately) a 200 volt supply, and it is easy to show that the dissipation even under dead-short conditions will be less than one watt.

Thus the control may be a 100K or 50K pot from the low voltage side of the dropping resistor to chassis. Since the circuit is purely a DC one, there is no problem of hum or any need to use shielded cables.

We tried this with one of our receivers using a two-stage sound IF similar to

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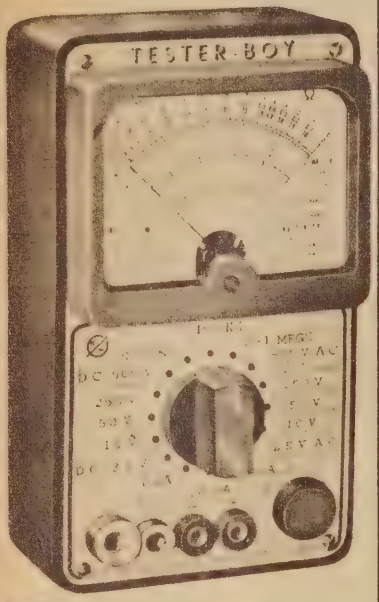

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4 Transistor "Awa" portable Radio, 5in x 3in x 1¼in, ... £19/17/6
"Silver" triple wave band 7 transistor, complete, portable with leather case and external aerial, £36/15/.
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the Q-Plus Mark II IF strip (August, 1957, page 72). This worked particularly well and has been in operation for several months with complete success.

However, when we tried this with the simpler single stage IF system, results were not so good. There was no doubt about the ability to control the sound, but there was a marked increase in frame buzz when the main volume control was advanced and the auxiliary control retarded. In addition, there was some difficulty in keeping the power dissipation within the limits imposed by the control pot, due to the lower values of HT decoupling resistors in these circuits.

We tried a number of other schemes which gave varying results but we feel that the one finally adopted is as good as is likely to be found. This simply shorts to chassis the audio line at the ratio detector.

It is completely effective as a volume control, requires only two wires (one earthed), while the impedance at this point is low enough to render shielded cable unnecessary. We tried the scheme on a length of cable far in excess of anything ever likely to be used in the home without any sign of hum pickup or instability of any kind.

MODIFICATION

These tests were made on the current receiver which uses two 10K resistors as load for the ratio detector diodes, and these are fairly common values. However, the 1957 "R., TV and H." Receiver used 56K resistors, and it might be necessary to reduce these to 10K if any hum or similar problems are encountered.

The best value for the remote volume control appears to be about 25K. Any substantially larger value will crowd the control action towards the lower end of the movement, while smaller values will reduce the output unnecessarily even at maximum value. The value of 25K results in smooth action and an initial loss of only 2 db. Dissipation is not a problem, and one of the miniature type controls will be quite adequate.

The muting switch may be either a "press-on" type (press to close circuit, release to open), or an "alternate on-off" type (press to close, press again to open). Both are available from electrical supply houses as small single hole mounting types, generally with a luminous button. The "press-on" type is usually used for bell pushes and similar applications, and the "alternate on-off" for bed lamps, etc.

Of the two we are inclined to prefer the latter, since it avoids the fatigue of holding the switch down for periods of more than a few seconds. However, the other type will prevent any confusion which may result from the set being switched off with the muting switch in the "off" position, resulting in an apparent sound failure when the set is switched on again later.

Brightness control is a fairly simple arrangement, since it is essentially a DC function. However, there are some points to be considered.

Unlike the volume control, the range of the brightness control can afford to be comparatively small. It is more of a vernier or auxiliary action to supplement the main brightness control. Assuming that the latter has been set approximately correctly in the first place, small changes only will be required to take care of program variations.

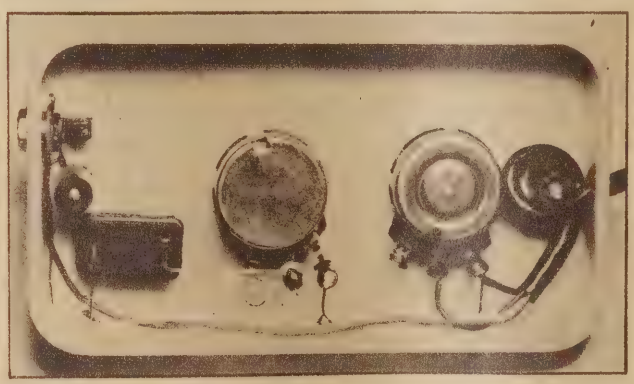
EXTRA RESISTOR

In some circuits the main brightness control circuit may have a small value of resistance between the brightness pot and chassis, mainly to "centre" the action of the control correctly. One example was the DC restoration circuit described in the July, 1958, issue, page 121. Such a resistor is likely to be between 22K and 33K.

Where such a resistor already is employed, it is a simple matter to arrange the auxiliary control to short it out progressively, this giving quite a good range of control where a typical value, as quoted above, is used.

However, where such a resistor is not employed, its addition probably would upset the action of the main brightness control, at the very least requiring that the resistor at the HT end of this pot be modified. To overcome this we evolved a slightly different arrangement.

This connects the auxiliary control between the moving arm of the brightness pot and chassis with a suitable limiting resistor in series with it, the latter serving several functions.



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Underside view of the unit shown on page 40. Muting switch and earphone socket are on the left, volume in the centre, and brightness on the right. Note pillars and screws to support the back.

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One is to prevent excessive dissipation in either the pots or associated resistors which might otherwise occur at certain combinations of extreme settings. Another is to limit deliberately the action of the remote unit to prevent it overriding the main control and completely blacking out the set. This could lead to confusion in a manner similar to that already mentioned concerning the muting switch.

Finally, it was found necessary to decouple this point, due to the presence of a small amount of frame energy. Fed along the cable to the control unit, in a conductor running parallel with the audio lead, it is possible to induce frame buzz into the audio system. The addition of a .1 mfd capacitor, plus the lim-

iting resistor, makes a completely effective decoupling network.

The value of 2M and .22M for the pot and limiting resistor respectively, should be suitable for use with most circuits, and the amount of control provided is perfectly adequate. In fact, it is much more than should normally be required. Once again, there is no dissipation problem and one of the miniature type pots should be quite suitable.

Some idea of the style and size of the finished unit can be gained from the photographs. The case we used is a moulded plastic unit originally marketed for use as a crystal or small transistor set cabinet. It measures approximately 4¼in by 2¼in internally, and was originally 1½in deep. We cut this down to approximately 7/8in deep internally.

The case is marketed under the "Jabel" trademark, and we are negotiating with the manufacturer to have these supplied ready cut to the shallower depth. However, if these are not available, or a case already is on hand, it is not a hard job to cut one down to size.

Mark out each side to a depth of 1in (external), then cut through one side at a time with a hacksaw. Leave a reasonable amount on the waste side of the line, then rub down to the line with emery cloth. This is best done by laying the emery cloth on a flat surface and rubbing the case gently back and forth.

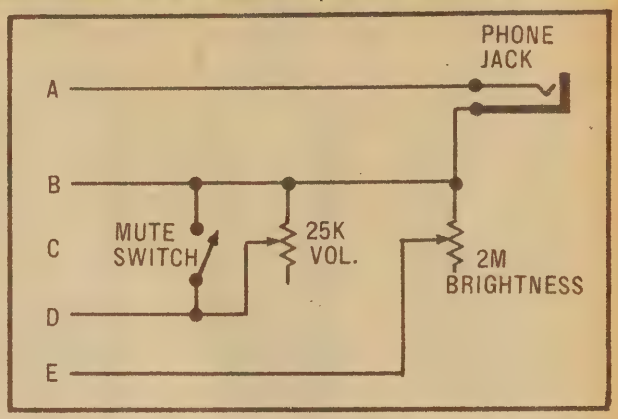
A back may be fashioned from a scrap of aluminium, Masonite, cardboard, or similar material. It is held in place with a pair of 1/8in round head machine screws, 1in or 1 1/8in long, with a pair of spacers ¼in long to support the back. Failing spacers, extra nuts may be used for this purpose.

It is suggested that the back be allowed to recess slightly inside the case, so that the securing nuts do not protrude. Four small rubber feet will further help to protect furniture or loung cushions. The cable is brought in through a small hole in the end of the case and looped around one of the pillars to prevent strain on the connections.

SIMPLE CIRCUIT, FEW PARTS

Circuit for the control unit shown on page 40. Values shown will suit all R, T, & H, circuits and most commercial sets.

At left is another version, with separate volume control for a hearing aid. The same layout could be used with a contrast pot in place of the extra volume control.



About the most satisfactory 3-core flex for this application is known as PVC Vacuum Cleaner Flex (23/.0076) and should be readily available from any electrical retailer. Although not as light as we would like, it is quite a neat, clean cable which will at least serve in a temporary capacity if nothing better is available.

TINSEL CABLE

Another type we tried was a cotton covered cable with four "tinsel" conductors, as used by the P.M.G.'s Department. It is light, flexible, and quite adequate electrically, but is rather hard to come by. Also, the tinsel type conductor is difficult to solder, while the cotton covering is not likely to prove popular with the womenfolk, being prone to pick up every scrap of fluff in the vicinity. However, if something like it is all that is available, it will do as a temporary measure.

A much better proposition is a four or five-core cable specially made for such applications. It can be much lighter than the vacuum cleaner flex, while a plastic covering is much cleaner than a cotton one. Electrically, the extra conductors can be very useful, making possible a very complete unit if this is required.

Some searching around the trade eventually revealed an ideal cable. It is finished in grey plastic, has five flexible conductors, and is only 3/16in in diameter. It is made by W. Hartland Manufacturing Co. Pty. Ltd., 945 Victoria Road, West Ryde, N.S.W., and this firm has agreed to make supplies available to selected distributors for the benefit of readers. It probably will be sold in 25ft lengths.

Next we require a socket or terminal on the TV receiver chassis into which this cable can be plugged. While it would be possible to fit these as extra components, such an arrangement is best avoided if possible. It means drilling, and possibly filing, the chassis, and the vibration could upset the IF adjustments. If we can use an existing socket, this will be a much better arrangement.

If a standard miniature four-pin speaker socket is used (as in the earlier "R., T Vand H.' receivers) we should be able to use this, since only two of the four pins are likely to be required. In addition, one of these probably will be earthed, which is required for one conductor anyway. This leaves us with two active pins, suitable for the volume and brightness circuits, while the active voice coil pin may be used for an earphone circuit.

5 PIN SPEAKER SOCKET

If we intend to use the fifth wire it is a simple matter to replace the four-pin plug and socket with the latest five-pin type. This is the same physical size and uses the same mounting holes, but has an extra pin in the centre.

The next facility to add to our unit might well be the earphone socket, with variations for deaf aid use where necessary. We will consider the simple earphone circuit first.

Assuming the availability of a fourth conductor, it is a simple matter to con-

(Continued on Page 105)

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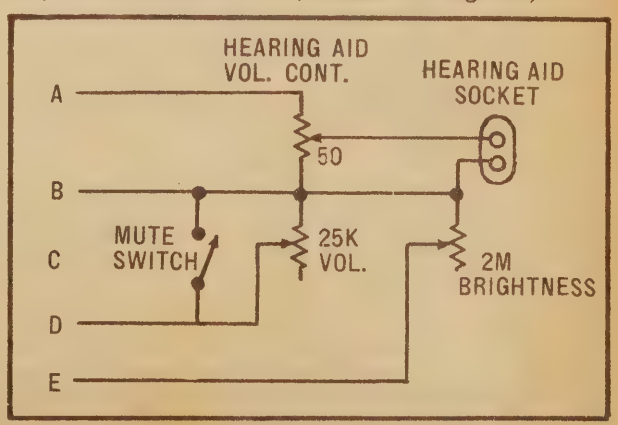
The circuit of the unit above left. This is intended for use with a magnetic earpiece of approximately 50 ohms. If crystal units are to be used, see text for details. A seven or nine pin valve socket may be used as an outlet socket for most hearing aid plugs.



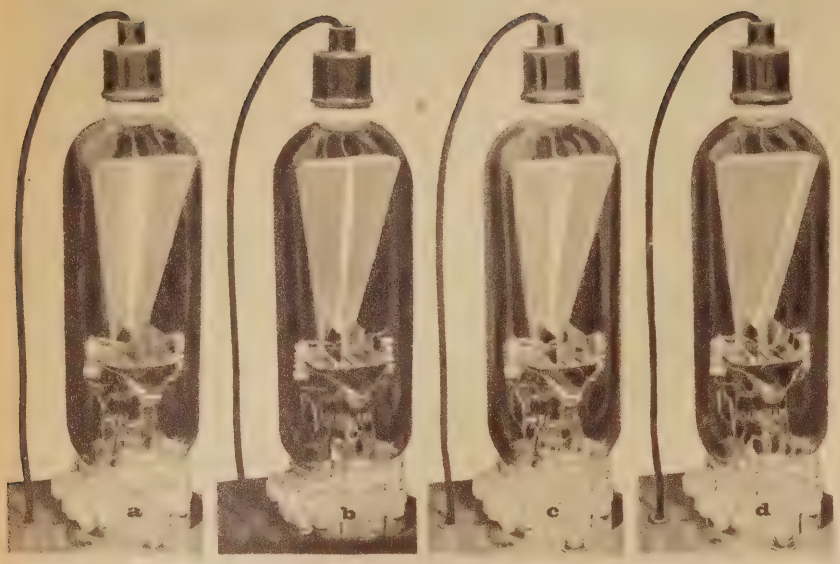


Figure 1: The above photographs show the AV43 under the following conditions: (a) with unfocused beam; (b) with beam focused; (c) with beam focused to crossover; (d) beam focused and deflected.

Novel Demonstration C.R. Tube

A new valve recently announced by the Amalgamated Wireless Valve Company will be of special interest to lecturers in schools and colleges, where lessons on electronics have to be given. Designated as type AV43, it is designed to make clearly visible the focusing and deflection of an electronic beam. The tube is available separately or included in a ready-built demonstration unit.

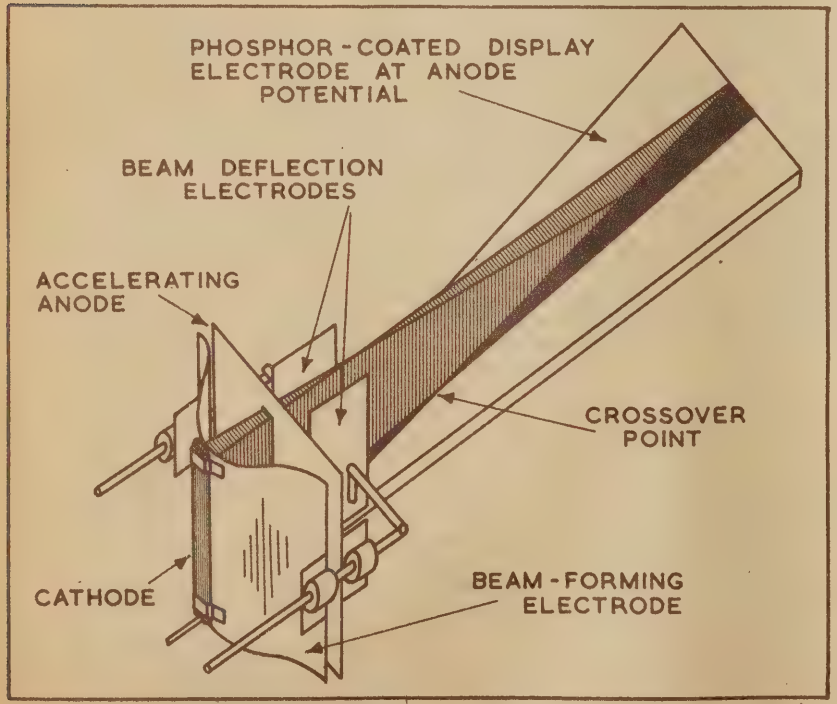


Figure 2: The electrode structure of the AV43. Though it differs obviously from an ordinary CR tube, it illustrates the behaviour of an electron beam much more clearly.

THE AV43 is a demonstration cathode-ray tube designed to illustrate electrostatic deflection and focusing, as well as magnetic deflection and focusing of a rectilinear electron beam.

The tube consists of an electron gun, which forms a strip electron beam, and a display electrode. The essential electrode structure is sketched in Fig. 2.

The strip beam is produced by associating a long indirectly heated oxide cathode, with two-dimensional beam-forming electrodes of the type proposed by Pierce (1940), designed to produce slight convergence so that the beam issues through a slot 1mm wide in the anode.

The display electrode, which is coated with willemite, is joined to the anode. The deflecting and focusing plates are mounted on separate insulated supports.

With the phosphor-coated conducting plate at anode potential held obliquely across the beam, potential conditions within the beam are unchanged, and a strip of phosphor will be excited which virtually gives visible sectioning of the beam.

The strip beam may now be deflected and focused, and the trace on the display

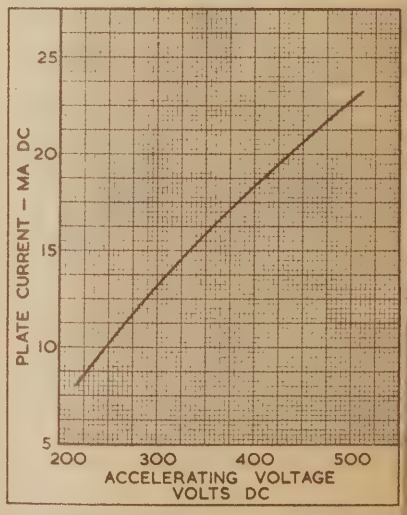


Figure 3: DC plate current versus accelarating voltage characteristic of the AV43.

electrode will, to all intents and purposes, behave like a visible electron beam.

Manipulation of the beam can be easily effected with externally applied magnetic fields.

The internal electrodes are designed to produce electrostatic deflection, and to illustrate the action of an electrostatic electron lens.

When the deflecting plates are at anode potential, the beam is seen to spread under the action of thermal velocities and space charge (Fig. 2a).

If the deflecting plates are tied together and their voltage with respect to the anode lowered, the electron len

SUGGESTED CIRCUIT FOR DEMONSTRATION UNIT

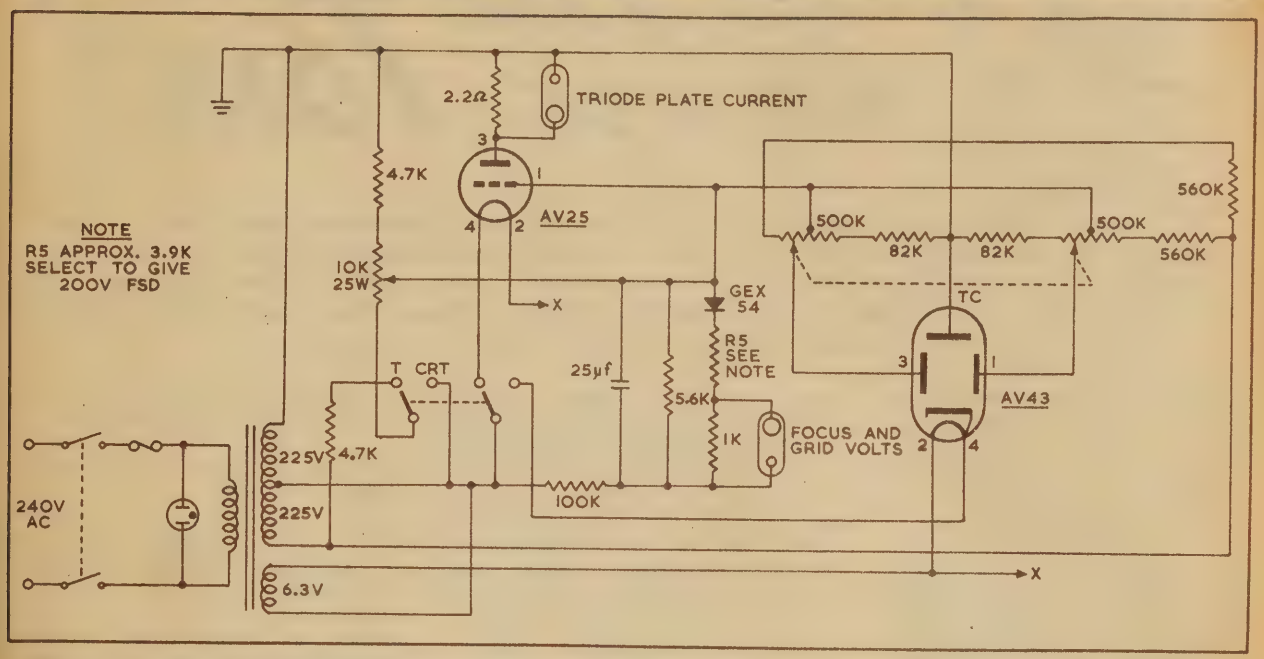


Figure 6: Suggested circuit for a two-valve display unit using an AV43 demonstration catnode-ray tube and an AV25 demonstration triode.

☆

Figure 4. (right) shows the circuit for AC operation of the AV43, while figure 5 (below) is for DC operation.

system can focus the beam to a thin line (Fig. 2b), or to a definite cross-over (Fig. 2c).

Finally, a voltage difference between the deflecting plates will produce a deflected beam (Fig. 2d). The beam can also be deflected by an external magnetic field, using either a coil or a permanent magnet.

An anode accelerating voltage greater than 200 volts is recommended for viewing under normal conditions. The DC characteristic of plate current—accelerating voltage is given in Figure 3.

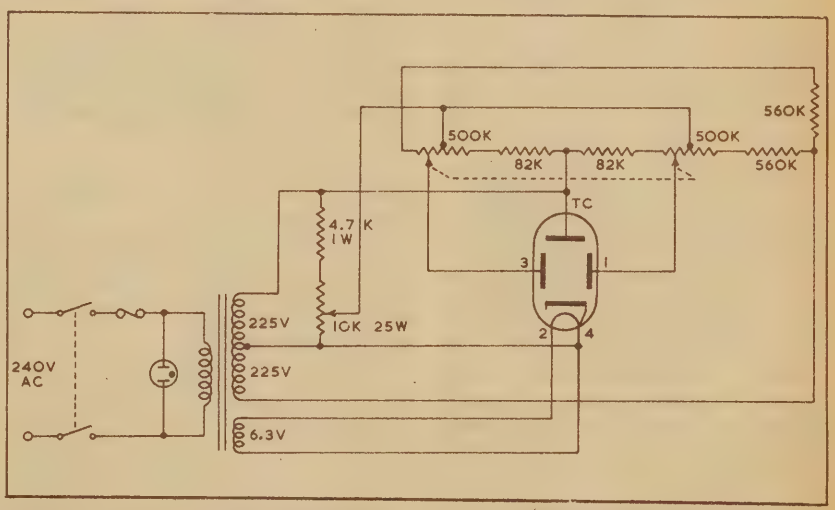
GANGED POTENTIOMETER

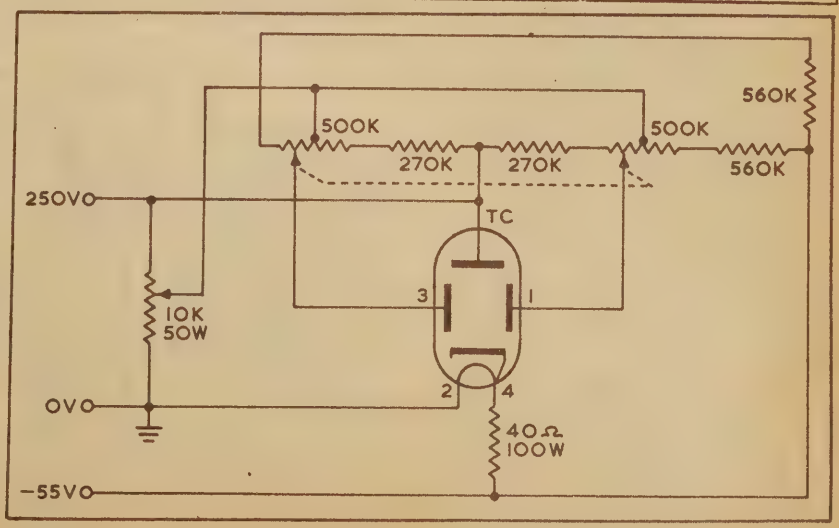
Circuits suitable for both AC and DC operation are shown in Figs. 4 and 5 respectively. In both cases a ganged potentiometer is used to prevent defocusing of the beam when it is deflected.

By this means, even when the deflection voltage (voltage between the deflection plates) is altered, the voltage at a point mid-way between the plates would still remain at the focusing voltage.

The AV43, in conjunction with the AV25 (a demonstration triode) is designed with educational uses in mind. It is natural, therefore, that the two valves be combined together in the one display unit.

The circuit used for this two-valve display unit is shown in Fig. 6. For further data on the AV25 Demonstration Triode, see "Radiotronics," Vol. 24, No. 1, January, 1959.





Here's your answer, Tom!

The field of electronics is a very wide one of which radio communication is only a subdivision. Its application to every day life and industry has increased enormously in the last few years. Beginners and advanced experimenters alike must have at times stopped to wonder, as Tom did, just what makes modern electronic equipment tick. The answers supplied in this feature should prove interesting and informative.

HOW does electronic heating operate and what are its uses?

Broadly speaking, Tom, electronic heating methods may be divided into two classes — induction heating for metallic objects and dielectric heating for non-conducting substances.

A metallic object when subjected to an alternating field will behave in the same manner as a conductor moving across a stationary magnetic field. Circulating or "eddy" currents will be induced in the body of the material, depending on its dimensions and the way in which it intercepts the moving lines of force.

Normally, in the design of electrical machinery, eddy currents are kept to a minimum by the lamination of armatures, transformer cores, etc. If no such precautions were taken, serious heating and loss of efficiency would result.

However, it is possible to capitalise on this disadvantage and base a heating process on the deliberate production of eddy currents. Induction or eddy current furnaces have been in operation for many years but, because the energising voltage is obtained from motor-alternators, operating up to 10Kc, they are not electronic in nature and do not concern us at the moment.

Where the nature of the work demands the use of higher frequencies, electronic methods are the only practicable means of generating the energising current and the valve oscillator plays a major part in this sphere.

The equipment usually consists of a high frequency generator with its power supply, terminating in a work coil where the heat is developed. The work coil is usually of copper tubing encircling the material to be heated. It is frequently water-cooled, since, although it does not generate much heat in itself, it receives a great deal by radiation from the object being heated.

Yet another phenomenon that normally presents some problems may be turned to good use in this form of heat treatment. This phenomenon, known as "skin effect," being the tendency for current to concentrate near the surface of conductors carrying very high frequencies.

If the frequency is such that the current is concentrated in the outer layers of a metallic object, heating will occur in those outer layers and only spread through the material by simple conduction. If the object is quenched before the heat has had time to penetrate the whole mass, a hardening effect, producing a hard skin and leaving the main body of the material unchanged, is produced.

Needless to say, the frequency must be high enough for the skin effect to concentrate the eddy currents in the outer layers of the material. Sufficient power must also be available to produce the required amount of heat to raise the desired depth to the required temperature in a sufficiently short time.

Dielectric heating, on the other hand, operates on completely different principles.

It is well-known that there are certain losses in insulating materials, which, if negligible at power frequencies, may reach considerable proportions at high frequencies. Hence the need for low-loss insulators and components on the short wavelengths.

Since these losses appear as heat, it is possible once again to capitalise on a disadvantage.

By placing a piece of material so that it acts as the dielectric of a capacitor and applying a high frequency voltage to the two plates or electrodes, heat will be generated in the dielectric, depending on the loss factor of the material and the voltage and frequency applied.

The outstanding feature of dielectric heating is that the whole mass of the dielectric becomes heated at once and uniformly. Thus it is possible to heat many materials which are normally poor conductors of heat. Among its many uses are those of welding PVC materials and of cooking and reheating foods.

★ ★ ★

Is there such a thing as a device for seeing in the dark?

Yes, Tom, there is a device to enable one to see in the "dark," though the accuracy of this term might be debated. It employs infra-red light, which is invisible to the eye.

Initially developed during the war, its principle of operation is to flood the object to be viewed with infra-red light, obtain an image by an ordinary lens system and translate this infra-red image into a visible one.

The heart of the gadget is a special tube which has the characteristics of the Iconoscope (or Emitron) and of the cathode-ray tube at one and the same time. Like the Iconoscope, it has a photo-electric mosaic screen, but one which is supersensitive in the infra-red end of the spectrum.

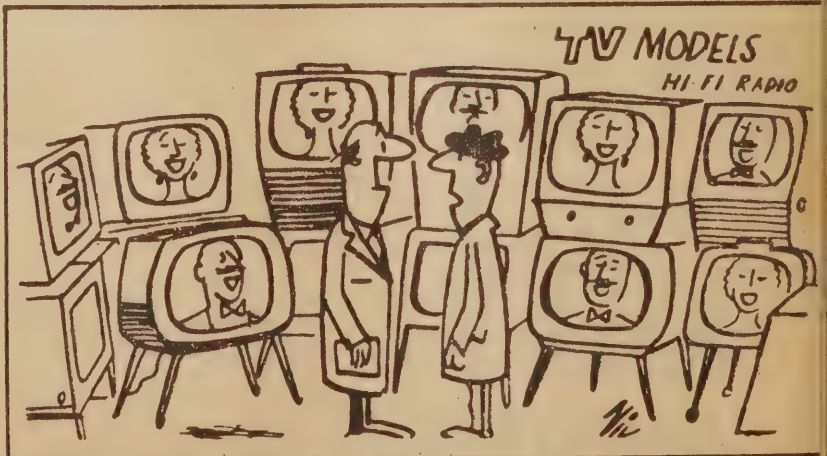
The lens focuses the optical image on this mosaic screen and the electron pattern thus released is focused electrostatically onto a fluorescent screen, where it gives a visible image that may be observed through an eyepiece.

The infra-red rays are obtained from an ordinary spotlight with a suitable filter.

★ ★ ★

What is meant by a compound-wound motor?

A compound-wound motor overcomes



"Can I see you alone?"

the individual disadvantages of series and shunt motors, whilst combining their advantages.

A shunt wound-motor will not start well under a heavy load, whereas a series motor will. Conversely, a shunt-wound motor will not revolve at a dangerous speed with a light or no load, but a series motor will.

By having one part of the field winding connected in series and another part in shunt with the armature, a motor or generator may be given almost any desired characteristics.

★ ★ ★

I have often seen the letters K.V.A. used on step-up or step-down transformers to designate their ratings. What do these letters mean?

The letters K.V.A., Tom, stand for kilovolt-amperes and represent the maximum current which can be allowed to flow through the primary or any secondary of a transformer, multiplied by the voltage present across that same winding.

If there were no losses in a transformer and if the power factor of the load circuit were 100pc. then the K.V.A. figure for the primary would equal the figure for the secondary (or secondaries) and it would also be equal to the power which could be drawn from the transformer expressed in watts.

In practice, these ideal conditions are not achieved and the kilovolt-amperes are always higher than the nominal power load in watts. Where the discrepancy is great, it might be possible to overload a transformer, even though the apparent load expressed in watts is well below the expected maximum.

For this reason, large distribution transformers are commonly rated in terms of K.V.A.

★ ★ ★

How does a carbon microphone function?

A carbon microphone consists of carbon granules inserted between two electrodes formed by the back plate and the diaphram. The principle of operation is that the resistence of the closely packed granules varies under varying pressure. The pressure variations are exerted by the diaphragm due to the sound waves impinging on it.

A DC potential is applied to the electrodes and produces a current in the external circuit which normally incorporates one winding of a transformer. As the diaphragm vibrates at speech frequency the contact resistance of the carbon granules varies at the frequency of the diaphragm vibration. As a result, the current flowing through the whole circuit will vary, rising and falling about a mean value.

The rise and fall of current through the transformer winding induces current in a secondary winding, usually involving a larger number of turns. This gives a voltage step-up effect so that movement of the diaphragm and varying current through the "primary" winding, produces a substantial signal voltage across the "secondary," which can be fed to an amplifier.

★ ★ ★

What is electrode dissipation?

Electrode dissipation, Tom, is the power dissipated in the form of heat by an electrode of a valve. The anode electrode usually dissipates the greatest heat due to its bombardment by electrons, but other electrodes also rise in temperature.

Screen grids, when carrying a large current, may also become hot and it is essential to observe maximum ratings in regard to screen voltage and screen current.

Anode dissipation is proportional to the anode supply current multiplied by the applied voltage.

When a valve has to handle considerable power, special precautions have to be taken to dissipate the heat generated at the anode, otherwise it would melt.

Generally speaking, for valves handling powers up to 100 watts, it is sufficient to make the anode large and robust or of selected material. However, for handling powers which are measurable in kilowatts, the other methods of construction are employed.

As an example of construction for high-power valves, the envelope may be made of silica glass and a jet of air blown on the surface of the envelope. In other high-power valves the anode electrode is not totally enclosed within the envelope, but is cooled externally. In one arrangement air is blown upon cooling fins attached to the anode; in another, water circulates over the anode surface.

★ ★ ★

What is residual magnetism?

Residual magnetism, Tom, is magnetism which persists in a paramagnetic material after the magnetising force has been removed.

In soft iron the residual magnetism is quite slight. In steel, it is so much greater that the material may become a permanent magnet after the application of a magnetising force.

★ ★ ★

What is a Robinson direction finder?

A Robinson direction finder is a direction finder in which an auxiliary loop-aerial is repeatedly switched in and out of circuit while a bearing is being taken.

The combined aerial system is rotated meanwhile, until a position is found at which the auxiliary aerial makes no difference to the signal strength, whether it is in or out of circuit.

At the point where this occurs, the auxiliary aerial must be in the position of minimum pickup or at right angles to the direction of wave travel.

The advantage of this type of system over that using a single loop aerial is that the signals remain audible all the time and communication need not be interrupted while bearings are taken.

★ ★ ★

What is a Skiatron?

The Skiatron is a device developed during the latter stages of World War II, to enable radar images to be enlarged without serious loss of brilliance. It also has been proposed as a method of providing large screen television.

Heart of the system is a special CRT screen replacing the normal fluorescent screen. Instead of fluorescing, this simply changes from a normally transparent condition to an opaque condition where it is bombarded by the electron beam.

It may thus be treated in the same manner as a film transparency and placed in a standard optical propection system. The amount of light available for the screen is then limited only by the efficiency of such an optical system.

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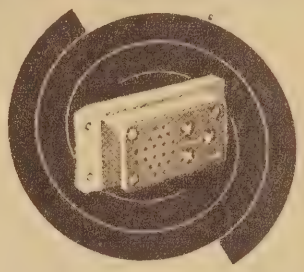

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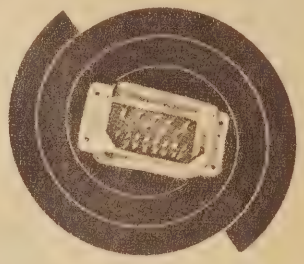

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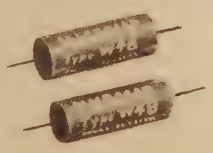

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FROM THE SERVICEMAN WHO TELLS

Summer always brings a crop of portables in for service and a couple of cases I encountered recently, while not presenting any outstanding technical problems, are typical of this kind of set. I also have some comments about a rather intriguing TV fault.

THE first portable was a valve model, owned by a yacht club type, and used mainly aboard his cruiser at weekends. His main complaint was that it wanted new batteries, but he also requested a general overhaul, adding that, ". . . it seems to be a bit distorted as well."

A few moments with the voltmeter confirmed that the batteries were in poor shape, being less than two-thirds their nominal value. However, the set would work, and there was no doubt about the distortion. In fact, it was so bad that I felt sure there was something more wrong with it than simply weak batteries. Supporting this idea was a lack of sensitivity not altogether in keeping with such a simple fault.

Nevertheless, I fitted a new set of batteries immediately, since these had to be provided anyway. This improved matters a little, but the distortion was still bad and the gain still poor.

Next I made a complete valve check, rather expecting to find either the 1S5 or the 3V4—or both—in need of replacement. Instead, these and all the remaining valves checked O.K.

SCREEN RESISTOR?

I replaced the valves and listened to the distorton again. Since it wasn't a valve I settled for the next most likely fault, a 1S5 screen dropping resistor either open or "gone high." As in the case of AC sets, the fairly high value of this resistor seems to make it more prone to trouble than most others in the circuit.

I was rather surprised, therefore, when the voltmeter showed ample voltage on the screen pin. The same applied to the plate circuit, while there was no evidence of positive voltage reaching the 3V4. Since this more or less exhausted the most common causes of audio distortion, I took a few minutes off to think about the problem.

I ran the meter over the connections again and suddenly realised that I hadn't taken a great deal of notice of the actual voltage on the screen pin. All I had observed was the fact that it wasn't down to a few volts as is normally the case when the resistor packs up.

Now, with more careful observation, I realised that it was, if anything, rather on the high side. And, as I realised this fact, I also realised the likely cause; corrosion due to the salt atmosphere in which the set spent a good deal of its life.

More careful checking confirmed my suspicion. Corrosion on the 1S5 screen pin had effectively opened the screen circuit. There was plenty of voltage on the socket contact, but none was being applied to the screen. And, of course, with no current flowing, the voltage at the pin would be higher than normal.

The trouble seemed to be confined to the valve pin, the socket apparently being quite clean. I cleaned the pin with a strip of fine emery, applied a drop of carbon tet. to the remaining pins and socket contacts as a precautionary measure, then checked the performance again. This time there was plenty of gain and the distortion had vanished.

I went over the remaining valves and checked for any sign of similar trouble which might be developing, but I could find nothing. In addition, there was no sign of trouble when the valves were rocked gently in their sockets, normally a sure way to aggravate such faults if they are lying dormant. I decided there was nothing more I could do in this regard.

A routine alignment check showed that sensitivity was approximately normal, but capable of some improvement due to one or two adjustments having drifted. Since the owner had expressed a desire to have the best possible performance in this respect, I took a little extra care with the job and the final result was a particularly "hot" set.

The moral of the story is, of course, tied up with the fact that I was trapped into making a false assumption, namely, that because there was voltage on the socket contact there was also voltage on the valve pin.

While I may have spotted this condition a few minutes earlier had I taken more notice of the voltage reading, I'm afraid that this is the kind of fault likely to go on trapping most of us for the rest of our days.

The point is that we do not have sufficient practice at this kind of fault. It is comparatively rare and certainly not frequent enough to justify any departure from the normal practice of making measurements off the socket contact. The fact that we get caught occasionally is just one of those things.

KEEP IT IN MIND

About the best we can do is to remember that this does happen every once in a while, and to consider it as a possibility whenever our observations and measurements seem to contradict each other.

Incidentally, since the valve read as normal in the tester, I can only assume that the socket contacts in the latter bore on a difficult surface of the pin.

The other portable was a transistor job; one of the pocket type, imported variety, with everything scaled down to about one-third the normal miniature size. In this case there was no problem of diagnosis, but the fault was an interesting one nevertheless.

The owner first complained that the set would not work at all, then followed this up with the statement that he could not switch it off. Yet, in spite of the apparent contradiction, what he said turned out to be literally true. The set certainly would not work; while closer examination confirmed that it was switched on and incapable of being switched off.

"HERRINGBONE" ON CHANNEL 2

The eleventh annual report of the Australian Broadcasting Control Board, recently to hand, makes some further comment about the problem of herringbone pattern on channel 2. This was discussed in some detail in these columns in the May, 1959, issue.

It appears that this trouble is still being encountered in a number of receivers and has been the subject of research by both the manufacturers and the board.

As a result of conferences between the board and the manufacturers concerned, it was agreed that a worthwhile improvement could be obtained by increasing the vision intermediate frequency to 36.874 Mc. This increases the beat frequency to 4 Mc., but appears to be the limit due to the appearance of other beat patterns around 1.5 Mc. as the I.F. is raised further.

More specifically, the board now recommends two discrete pairs of frequencies. Operation between these frequencies is not recommended. The frequencies now suggested are:

Vision: 36 or 36.875 Mc.

Sound: 30.5 or 31.375 Mc.

While directed mainly at manufacturers and design engineers, it would be advisable for the serviceman to keep this point in mind. It is probable that some manufacturers may recommend that existing receivers be changed where other methods fail, while it may be worth trying, anyway, in a particularly stubborn case.

On the other hand, the trap described in the May issue is remarkably effective in many cases, and is a good deal simpler. It would seem wise to try something like this before involving a set owner in the cost of a complete realignment job.

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How did the customer know it would not switch off? Simply because the switch on the pot no longer made any obvious click when the volume knob was turned to the "OFF" position. Of course such a diagnosis was pure chance, because it could just as easily have been the other way round, with the set inoperative because it was failing to switch on.

In fact, I imagined this was what had happened until I opened the set and commenced to make some simple checks. Then I quickly realised what was wrong and why.

Both troubles were due to the switch pot. This, like everything else, had been scaled down considerably, being only the diameter of a threepenny piece and about 5/16in deep including the switch mechanism. The pot section proper was only 3/16in deep.

The construction was quite ingenious in most respects, and everything had been done to simplify the mechanism in order to achieve these dimensions. Unfortunately the simplification seemed to have been carried a little too far, resulting in the present trouble.

Somehow the knob had been forced past the stop at one extremity or the other, "butchering" the tiny wiping contact in such a way that it no longer made contact with the element. This was the cause of the set being inoperative. In addition, the wiper and other parts of the pot were so tangled up that the shaft could not turn far enough to operate the switch. Since this latter was in the "ON" position, it had to stay that way.

(The owner confessed that the set had been in this condition for several days, he being unable to get it to me earlier. Although worried about the effect on the batteries, it apparently had never occurred to him to simply take these out of the case.)

Fortunately there was no problem about a replacement pot. I contacted the local agents and they advised that they were available ex-stock. I placed an order and delivery was promised the following day.

In the meantime I took another look at the pot in an effort to determine just how it had come to be butchered. Was it the result of sheer brute force on the part of the user, or had the stop mechanism failed to do its job properly?

DESIGN WEAKNESS

While I was inclined to the theory of brute force, more careful examination showed that the fault was really in the pot itself. The body of the unit was of moulded bakelite and part of this moulding included a projection from the inner wall to act as a stop.

This was supposed to engage a small metal tongue which slipped over the main shaft, along with the wiper contact, both being held in place by a bakelite disc which also acted as a top cover for the whole unit.

This was the weakness. The tongue could only work correctly while it was held in place by the bakelite disc. Without the disc, it simply rode up the shaft and over the top of the moulded stop. And this was exactly what had happened, because the disc was only cemented in place, and none too securely at that.

It may not have mattered if the pot had been mounted with the front against some part of the case or printed board, in the conventional manner, since the pressure on the disc would have held everything in place. Instead, it was mounted with the rear against the printed board, with a small cutout for the switch mechanism. Thus there was only the cement to hold the disc in place.

Summing up, I feel that an otherwise carefully designed component has been spoiled for the sake of the traditional ha'p'worth of tar; in this case just a little more care in designing a suitable cover.

When the new pot arrived I fitted it wi hout any trouble, replaced the batteries, and tried the set. It worked quite well, but a check on the batteries showed they were on the way out. They probably had been weak, anyway, and three or four days' continuous running proved the last straw.

With new batteries fitted the performance was noticeably better and quite impressive in regard to sensitivity. Acoustic output was, of course, limited by the small speaker, but was quite adequate for personal listening. Holding the thing in one hand while it poured forth the latest hit tune I couldn't help comparing it with its counterpart of a mere 10 years ago.

We've certainly come a long way in that time, at least technically, if not musically.

Turning to TV: A fault which I encountered this month reminded me that, while I had come to accept the symptoms it produced, I had never really taken the trouble to find out just why this particular fault causes a set to behave as it does.

In this case the set belonged to a customer who had a passing knowledge of radio, sufficient to make an intelligent guess at the simpler types of radio faults, even though he had not practised it as a hobby for many years. As far as TV was concerned, he was content to simply turn the knobs and watch the picture, leaving it to someone else to worry about the inside when something went wrong. However, he did like to know the reason why a set had failed.

TROUBLE

The first sign of trouble occurred one morning when he switched the set on for the early morning news session. The set warmed up normally, gave forth a bright picture for a few seconds and then commenced to misbehave. First the picture became noticeably darker and then the owner realised that it was shrinking as well, the entire picture being inside the mask.

The picture became darker and darker and smaller and smaller, until it was a barely visible image about six by eight inches. At that point it lost horizontal hold, just before fading out completely. The sound had been affected too. Although still present it was very weak, requiring the control to be turned full up to produce even a moderate level.

At this point the owner switched off, quite convinced that the set was faulty. He hurried off to his office with the idea of calling me and requesting that I take a look at it. However, before he had a chance to do this, his wife rang him to say that she had switched the set on again and it was perfectly normal. Perhaps he didn't need to call the serviceman after all.

Thinking it over, he decided that perhaps his wife was right. He remembered one previous occasion when the set had behaved similarly, though less drastically, due to a temporary drop in line voltage; a fact which was made obvious on that occasion by the effect on the light globes.

Could this morning's failure have been due to a similar, though more severe, power failure? Since there were no other appliances in operation at the time, this would not have been obvious in any other way. On the strength of this, he decided to defer calling me for a few days.

And, for the next few days, the set did behave itself reasonably well. Once or twice he noticed that the picture had crept inside the mask a little just after switching on, but he assumed that this could be due to line voltage.

Then, just when he had convinced himself that all was well, it happened again. The same initial picture, the same shrinking and darkening, the same loss of sound. Only this time the picture came good again almost immediately

"CROSS-TALK" PROBLEM IN TV RECEIVER

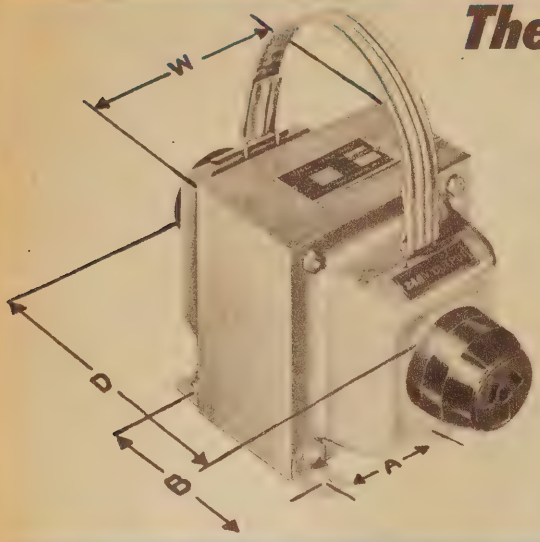
One of the problems sometimes encountered by home builders of TV sets is that of "cross-talk" in the deflection yoke. This manifests itself as a wavy pattern in the horizontal lines on the left hand side of the screen. It may occupy between one and two inches in most cases.

There are several approaches to this problem. Referring to the November, 1957, and May, 1958, circuits attention should be given to the 100 pf., 2,500V capacitor connected to pin 3 of the THO1 line output transformer. This value appears to be important in individual receivers and may be varied experimentally for best results. A value of 47 pf. appears to be a suitable alternative in many cases.

Another approach is to use a type CHW1 width coil in place of the CHW2, following the circuit arrangement used in the May, 1957, circuit. The CHW1 is less effective as a width coil, but almost completely free from ringing effects. Provided it can give adequate control it is a very effective solution.

The CHW1 has only a single winding which shunts the same section of the line output transformer as the present CHW2. There is no series coil, however, so that the 2,700 ohm and .0022 mfd damping components are unnecessary. The line from pin 8 on the yoke socket runs directly to connection 1 of the line output transformer, as also does the 22pF. 2,500V capacitor.

Attention also should be paid to the dress of the leads to the deflection yoke. Capacitive coupling between the vertical and horizontal leads should be reduced to a minimum, and we have known cases where this was all that was required to cure the trouble.



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Type	Sec. Volts. AC	Watts	Type of Outlet	No. of Outlets	Dimensions (in inches)				
					H	W	Max. D	A	B
B12/7	4, 8 & 12	7	Terminals	1	2"	2⅜	5⅛	3⅛	
Scope Trfr.	3.3	30AInt.	"	1	3¾	3⅛	3⅞	2½	1⅞
FT6/15	6.3	15	Leads	1	1 15/16	2⅜	1⅞	1⅞	
BT7.5/11	7, 5, 8, 5, 9, 5 & 11	11	Terminals	1	"	"	"	"	
SD6/18	6	18	"	1	3¾	3⅛	2¾	2½	1⅛
SD6/30	6	30	"	1	"	"	3⅞	2½	2
SD6/60	6	60	"	1	"	"	4	"	2⅛
SD6/100	6	100	Terminals	1	"	"	4¾	"	2⅞
SD12/60	12	60	Terminals	1	3¾	3⅛	4	2½	2⅛
SD2/100	12	100	"	1	"	"	4¾	2½	2⅞
SD32/60	32	60	2 Pin Polarised	1	3¾	3⅛	4	2½	2⅛
SD32/100	32	100	" " "	1	"	"	4⅞	"	2⅞
SD32/175	32	175	" " "	1	4¾	4⅛	5⅜	3¼	3
SD32/250	32	250	" " "	1	"	"	6	"	3¾
SD32/500	32	500	Terminals	1	6½	5 3/16	5 5/16	3 3/16	5 15/16
SD32/1000	32	1000	"	1	6¾	5⅜	9	—	—
SD110/25	110	25	2 Pin	1	3¾	3⅛	3½	2½	1⅛
SD110/60	110	60	" "	1	"	"	4	2½	2⅛
SD110/100	110	100	" "	1	"	"	4¾	"	2⅞
SD110/175	110	175	" "	1	4¾	4⅛	4¾	3¼	"
SD110/250	110	250	" "	1	"	"	5⅜	"	3
SD110/400	110	400	" "	2	6½	5 3/16	4⅜	3⅛	5
SD110/500	110	500	" "	2	"	"	5 5/16	3 3/16	5 15/16
SD110/750	110	750	" "	2	8⅛	6¼	4⅜	4 3/16	4 15/16
SD110/1000	110	1000	" "	2	"	6⅜	5 3/16	4⅜	5 13/16
IS240/150	240	150	3 Pin	1	4⅛	3 7/16	4¾	2¾	2⅜
IS240/250	240	250	" "	1	4¾	4⅛	5½	3¼	3⅜
IS240/500	240	500	" "	2	6½	5 3/16	5 5/16	3 3/16	5 15/16
IS240/1000	240	1000	" "	2	6¾	5⅜	9	—	—

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and remained that way for the rest of the evening.

This time there seemed no doubt that the set was at fault, because there had been no evidence of severe line voltage drop while the set had been staging this little act. Nevertheless, he decided to try it again the following morning before calling for yours truly.

When it turned on another display of temperament he reasoned that there could be no further doubt. Being Saturday morning he hurried around to my shop and told me the whole story.

"It had me tricked," he confessed, explaining his delay in calling me, "I couldn't understand how it could come good so completely if there was something wrong with the set. In fact, I still can't understand it. Do you think it will be hard to find?"

I don't usually make snap judgments on the strength of a customer's observations, but I felt I was on fairly safe ground this time.

"No," I replied, "I don't think it will be hard to find. In fact, if your observations have been accurate I would say it is almost certain to be a faulty rectifier valve. To be more precise, a gassy rectifier valve."

I was right too, as it turned out, but the customer is still trying to work out what kind of a rectifier fault would cause such a complex cycle of events, or how I was able to nominate the trouble so positively.

I can understand his bewilderment because I was almost equally puzzled myself the first time I struck the fault. My first thought was that one of the electrolytics was playing up, suffering some form of temporary breakdown, then coming good with the continued application of voltage.

But it was the rectifier all right, though, at the time, I was more interested in getting the job finished than worrying about the finer points as to just why it behaved as it did. Since then I have encountered the fault fairly regularly, so that it may now be regarded as one of the routine variety.

But why does it behave like that? My curiosity aroused by this customer's queries, I approached an engineer from one of the valve companies to see if he could offer some explanation.

While pointing out that there are many variables and that it is impossible to be specific, he suggested that the following may be a possible explanation of the phenomena:

EXPLANATION

First it must be assumed that the valve has become "gassy" for some reason, either as a result of over running, the development of a microscopic leak at one of the seals, or just plain old age. Whatever the cause, the initial gas content is absorbed by the "getter," thus preventing any serious upset to the valve operation.

But, if the evolution of the gas continues, there must come a time when the getter can no longer take it up, so that it will begin to interfere with the operation of the valve.

During a particular "off" period, particularly if it should be a long one, this gas could poison the cathode and also be absorbed by the plates. When the valve is subsequently switched on again, the cathode will reach operating temperature almost immediately, but little or no current will be drawn for about 30 seconds, until the remaining valves warm up.

This period may be sufficient for the cathode to "cure" itself of the poisoned condition, at least to some extent, so that it is ready to function by the time the set draws current. This gives us our initial picture on the screen after a normal warm-up period.

However, as soon as the rectifier plates rise in temperature, due to the flow of current, the gas they absorbed will be released and, if in sufficient quantity, this can poison the cathode again, even while it is heated. Thus the cathode becomes less and less able to emit electrons and the HT will drop quite rapidly to possibly less than half its normal value. (As in the particular case cited.) We now have no picture and very little sound.

RECOVERY

At this stage the valve will very often recover after only a minute or so, and remain functioning as long as the set is left on. It seems difficult to arrive at a satisfactory explanation as to why this is so.

The valve engineer's explanation was that the gas from the plates would, initially, be concentrated in the plate cathode region, but would eventually disperse throughout the valve and the lower concentration would enable the cathode to cure itself again.

However, while talking this over with the Technical Editor, he expressed doubts as to the accuracy of this reasoning. While admitting that he was not an expert on valves and their behaviour, he felt that the idea of a concentration of gas in a small chamber was contrary to natural laws which would require the gas to disperse itself to equalise the pressure.

He suggested that two other possibilities might be considered. One assumed that the gas between the plate and the cathode might be ionised, not necessarily immediately, but as a result of a cumulative action as a few electrons were liberated from the cathode and managed to penetrate the gas screen.

Such an effect could result in reasonable rectifier efficiency while it lasted, but only at the expense of cathode life. The ions created by collision with the electrons would travel towards the cathode, bombarding it with enough force in most cases to dislodge the active cathode material.

(Actually, ion behaviour in a rectifier might be quite complex because of the alternating voltage on the plates.)

The other was that the getter was not completely exhausted, but still able to function to a limited degree when the valve was hot. Thus any gas released from the hot plates might have to wait for the getter to reach an operating temperature before it could be absorbed.

It is interesting to note that, in the emission tester, they usually show a very poor emission initially, with a pronounced blow glow inside the plate region. Then, if the test button is held down for several minutes, the emission slowly creeps up the scale while the blue glow becomes less and less. Finally it vanishes altogether, and the meter reads somewhere around the top of the "Bad" scale or in the "Doubtful" sector.

All of which is rather inconclusive I'm afraid, but that is about all I have been able to discover so far. Perhaps someone else may have some ideas or observations which may help.

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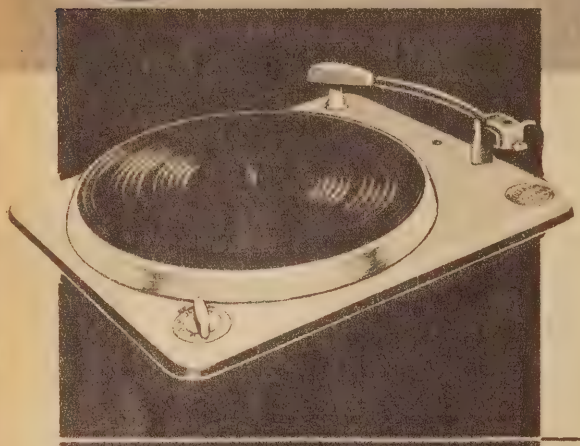

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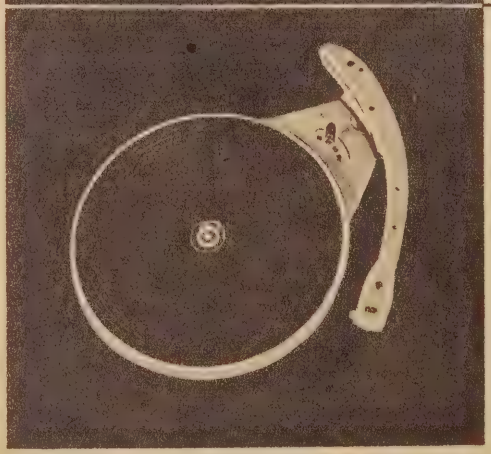

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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

BEATING HUM PICKUP FROM TURNTABLE MOTORS

The author wrote to us a few weeks ago and complained about hum troubles when he changed from a crystal to a magnetic stereo pickup head. His perseverance with the problem has been rewarded however, and many of our readers will be interested in his findings. We quote his letter verbatim.

By A. J. Barnes

FOR several months after building the "R., TV and H" twin ten-watter with crystal control unit, my wife and I were content to sit back and delight in the colossal performance of the amplifier and the thrill of properly presented stereo recordings.

Although we are thrilled by our collection of good recordings of classical music I don't mind admitting, in spite of sneers from some quarters, that the trains, the bowling alleys and the kids along the picket fence will never lose their thrill for us.

It was sheer greed that started the trouble; greed and the fact that "R., TV and H." brought out the stereo control unit for magnetics.

We got to thinking that the outfit would sound even better with a high-fi magnetic head, so home we came with a kit of pre-amp parts and 19 quids' worth of pickup cartridge!

Pre-amp built and plugged in, pickup cartridge changed over and weight adjusted, I switched on the power, not noticing that the volume control and bass boost were full on.

THUNDEROUS ROAR

Nothing happened for half a minute then the house shook with a thunderous roar. I thought the Axiom 400 cones were about to leap out their housings.

Hum — and how! For a fleeting moment I thought I must, in some crazy way, have got the heater volts across the input socket.

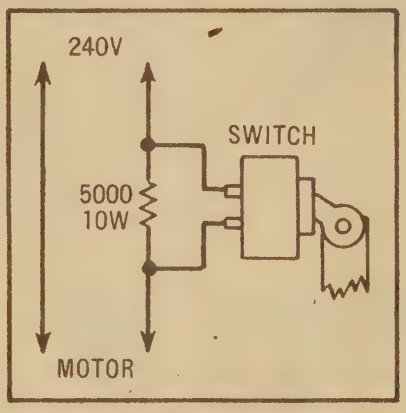
It was 50-cycle hum all right and it didn't take long to see, or rather hear, that it was induced in the pickup coils by the field from the motor two inches below, although turntable and baseplate separated them.

What a disappointment and what a problem!

"It was going beautifully," she said. "Why did you want to fiddle with it?" Blow me down, I had no answer then; but we both know now, for our magnetic pickup is working beautifully.

She says, "I can understand all the words now," and I agree. There's no doubt about the superior fidelity of the magnetic. For the benefit of all interested parties, that dame in "My Fair Lady" says—"lots of coal miking lots of 'eat."

Our record player is a good one of well-known make—good for crystals that is—but it had a steel turntable and a steel baseplate.



Switch wiring to insert resistor in series with motor when in "play" position.

The big handbook said that steel turntables were no good with magnetic pickups so I spent a couple of days in the workshop making a complete new motor base from 14 gauge hard-drawn copper and a turntable from three-sixteenths brass.

Result? Only a very small reduction in hum!

"Ha," they said, "You got earth loops in pickup leads—you gotta shield this, that and the other."

No good, and I chewed fingernails.

Starting on a new tack I thought, Can I reduce the intensity of the hum source? So I put a 60-watt bulb in series with the motor, but still no decrease in hum.

Wondering if the motor would run I then tried a 15-watt bulb in series. It did, with no apparent decrease in torque but with a very noticeable decrease in hum pickup. At last, a promise.

NOW QUIET

To cut the story short may I briefly say that we have a dead quiet motor without hum pickup and without rumble or wow—with a 5000-ohm 10-watt resistor in series.

The secret is this:— The shaded-pole motor, as used on turntables requires a heavy starting current but, after getting up to speed, will run on the smell of an oily rag.

I was able to turn our motor switch over so that it is now "ON" when it used to be off (It remains mechanically linked to the drive-wheel shaft).

The resistor is hooked across the switch. When the main switch is turned on the motor runs free on full power. When the motor switch is turned "ON" the resistor is introduced in series with the motor at the same time as the drive wheel engages the turntable.

Simple isn't it? But don't some blokes do things the hard way?

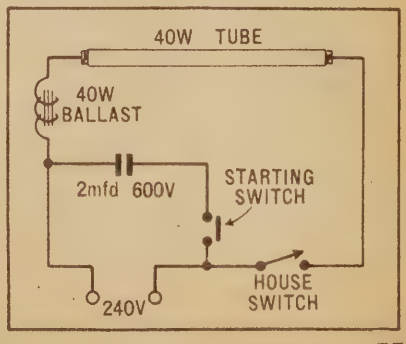
BURNT-OUT FLUORESCENT TUBES

Inspired by an old Reader Built It article, our correspondent, Mr D. O'Keefe, of Newcastle, evolved a method for using burnt out fluorescent tubes. He claims that previously unserviceable tubes light immediately and burn as well as new ones.

APPARENTLY Mr O'Keefe tried, unsuccessfully, to operate burnt-out tubes from the full winding of a 385 volts per side power transformer, as suggested in an old Reader Built It article. Undaunted, Mr O'Keefe experimented. We quote his letter.

"I got a burnt-out 40 watt tube and connected it in series with a 40 watt ballast (to limit the current) across 240 volts AC. I also connected a 2mfd capacitor in series with a push button switch across 240 volts AC. The capacitor has a rating of 600 volts.

"To start the fluorescent tube, pull the normal house switch and then the push button switch. The tube lights immediately and works well."



The pictures to the left and below give some idea of the suggested cabinet design, though they lose completely the very attractive effect of the color scheme. The woodwork is polished "golden oak," plastic cloth figured lemon-yellow, control panels brown anodised, with knobs, handles and edge trim in gold.

Cabinet Design For Your Playmaster

Here is a suggested design for a cabinet to hold your Playmaster amplifier equipment. It is not an expensive item and should be well within the capacity of a home handyman to build, using the tools normally available to him.

By Neville Williams and Wes Yashin

HOUSING the amplifier equipment is always something of a problem, particularly in these days of stereo and television, when the average loungeroom is likely to be overcrowded with "cabinets and things," as wives are wont to call them.

Of necessity, priority of space and position has to be allocated first to the twin speaker cabinets, and perhaps the TV console, leaving the very necessary amplifier, tuner and turntable equipment to go where it can.

The position would be ever so much easier if we could simply suggest adding an extra section to one of the speaker cabinets, to house this gear but such a course necessarily involves compromises which many hi-fi enthusiasts are not willing to accept.

Chief of these is the very great difficulty of preventing acoustic feedback between the speaker and the pickup.

Normally, this becomes evident as a low-pitched growl, whenever the gain or bass control is advanced but, even if not sufficient to sustain active feedback, it can accentuate turntable rumble and give the bass a kind of "hangover" effect.

It is perfectly true that many single-unit radiograms are sold on the commercial market, with speaker and turntable in the one cabinet but few of these boast the order of performance which amplifier enthusiasts seek to achieve.

Another important point is that records can be enjoyed best when the equipment can be operated from the listening position rather than having to take short walks across the room for each adjustment that may seem necessary.

Having made a case for a separate equipment cabinet, there follows the natural question as to its shape and size.

Modern styling seems to call for the "long, low look," which is just fine if you have a long, low loungeroom, with plenty of floor space to be occupied. For reasons stated earlier, something with a "short, high look" is often much more practical, occupying as little floor space as possible.

Another very familiar problem is that all cabinets (it seems) MUST have ornaments stood on top of them. Thus, to play a record, the ornament must first be removed and put somewhere, before the lid can be lifted to gain access to the turntable, the controls and even the radio tuner.

ROOM LAYOUT PROBLEMS

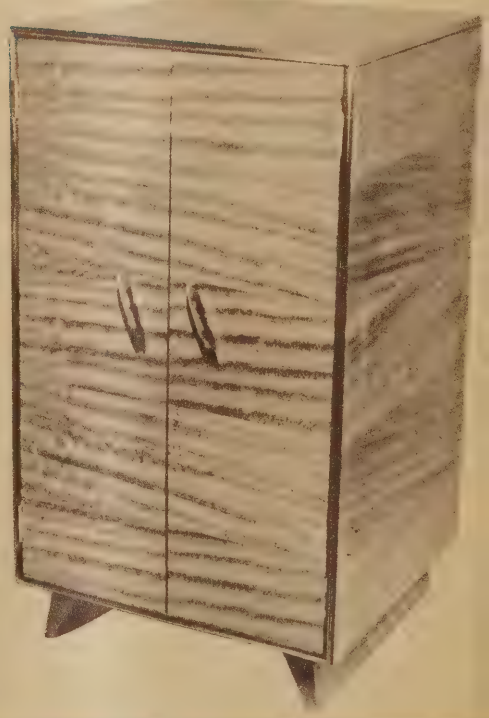
Since all vacant spaces in the room are already occupied by other ornaments, except the rather precarious position on the arm of a particular chair, it is often easier to forget the whole idea and just watch television.

Either that, or you bow to the inevitable and build a cabinet in which access to the turntable and the controls can be had without lifting the lid.

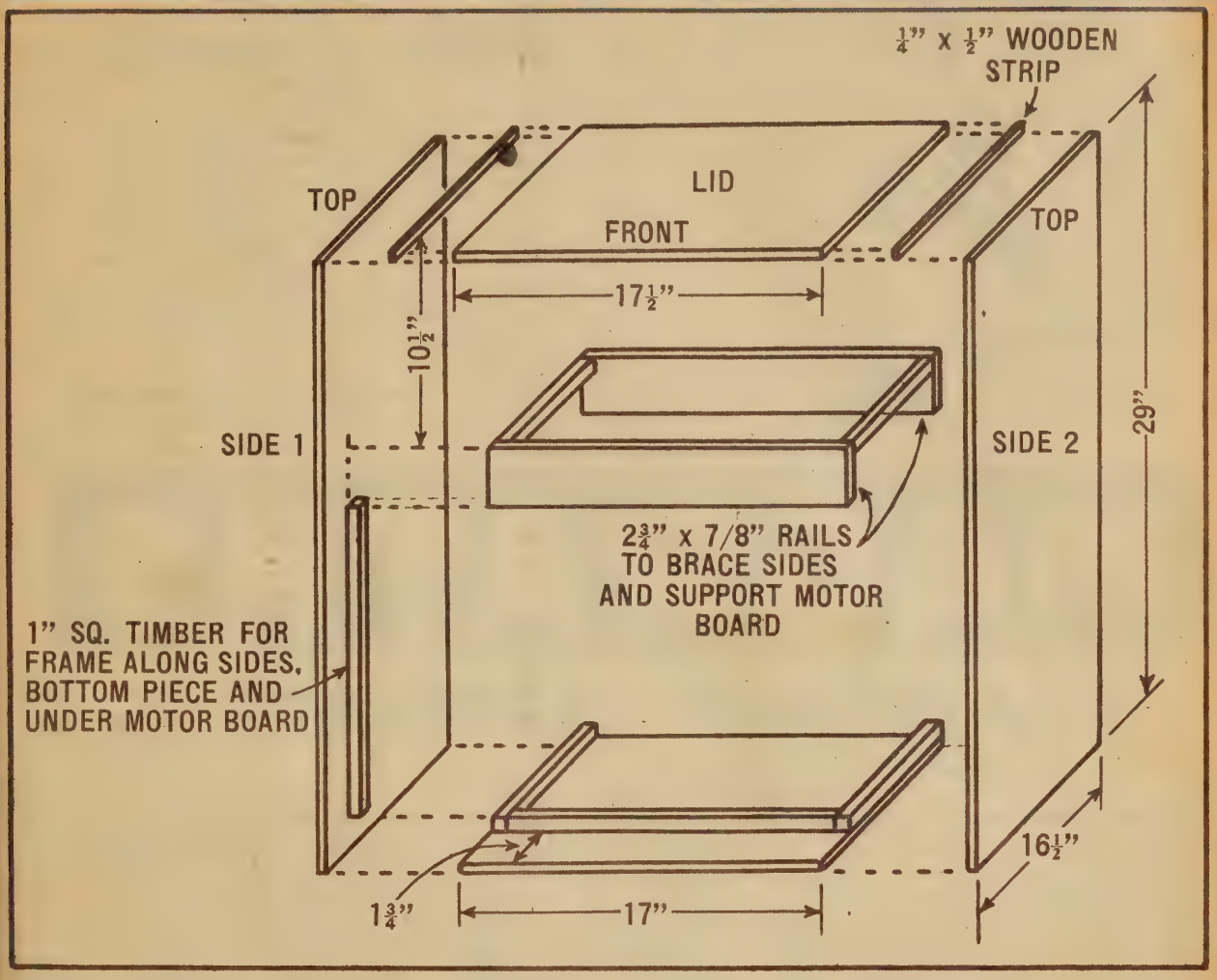
Then there is the problem of changing equipment. Every hi-fi enthusiast worthy of the name has built at least three or four amplifiers which are "definitely the last." These have probably involved purchasing an equal number of "last" pick-ups and motors.

Ultimately the problem becomes one of having so many holes in the cabinet face and motor board that there isn't enough wood left in which to drill any more.

To meet this situation, it is a very good scheme indeed to make both the



DIMENSIONAL DIAGRAM FOR EQUIPMENT CABINET



This diagram gives the essential dimensions of the original cabinet. They should be checked against individual requirements and modified as necessary, particularly in respect to clearance between the underside of the motor, the tuner or control unit and the front panel.

motor board and the operating panel disposable, so that they can be replaced when, and as often as necessary.

Last but not least, the whole thing should be no more expensive to build than absolutely necessary. Since it does not have to withstand the acoustic pressures of a speaker cabinet, merely requiring to be rigid as a piece of furniture, the cheapest and simplest approach is to plan the dimensions so that the whole thing can be cut out of a single sheet of half-inch ply, supplemented by glue, screws and cleats.

So to the design suggested herewith.

DIMENSIONS AND DETAILS

Overall, the cabinet measures 33in high, 18in wide and 16½in deep.

Access is available by a lift-up lid and by twin doors in the front. The lift-up lid does not normally require to be used, however, since the pickup and motor can be operated easily through the front doors, in keeping with one stated requirement.

The motor board measures 17 x 15½in, which is large enough to accommodate most motor/pickup combinations. It is held in place by four screws only, so that it can be removed and/or replaced very simply at any future date.

The control unit and tuner mount in a panel below the motor board, which can be made of anything from a fibreboard to heavier plywood. We have suggested covering the surface within a figured plastic cloth for decorative purposes, the cloth in the original being a lemon-yellow shade, behind a pattern of brownish lines.

Once again, this is held in place only by screws and can be replaced or recovered cheaply and easily, without affecting the rest of the cabinet.

It may be argued that this arrangement puts the controls too low for comfort and this is a valid criticism. However, it must also be realised that the controls will more commonly be operated from an easy chair or a cushion than from an erect position.

In any case, it is difficult to visualise an arrangement which will make them more accessible, without making the pickup less so, or involving a larger cabinet or more difficult cabinet work.

As it is, all important surfaces of the cabinet can be cut from a single 6ft by 3ft sheet of plywood, in such a way that the grain pattern is preserved. Stained and lacquered (or polished) and fitted with gold handles and trim, the finished cabinet looks a quite handsome piece of furniture — with or without an ornament on top.

Having disposed of the preliminaries, we can turn the article over to Wes Yashin, who did the actual constructional work.

TIMBER

The first step will be a trip to your local hardware store or timber yard to select a suitable sheet of plywood.

As mentioned earlier, a single 6 x 3 sheet of half-inch plywood will yield sufficient material for the complete cabinet, apart from internal cleats, etc.

Doubltess plywood will be available in several timber finishes and personal taste will dictate the choice. Maple ply is probably the most plentiful, and the easiest to obtain, being also very popular as a finish for furniture.

Watch the grain on the piece you select. Avoid any irregularities so that

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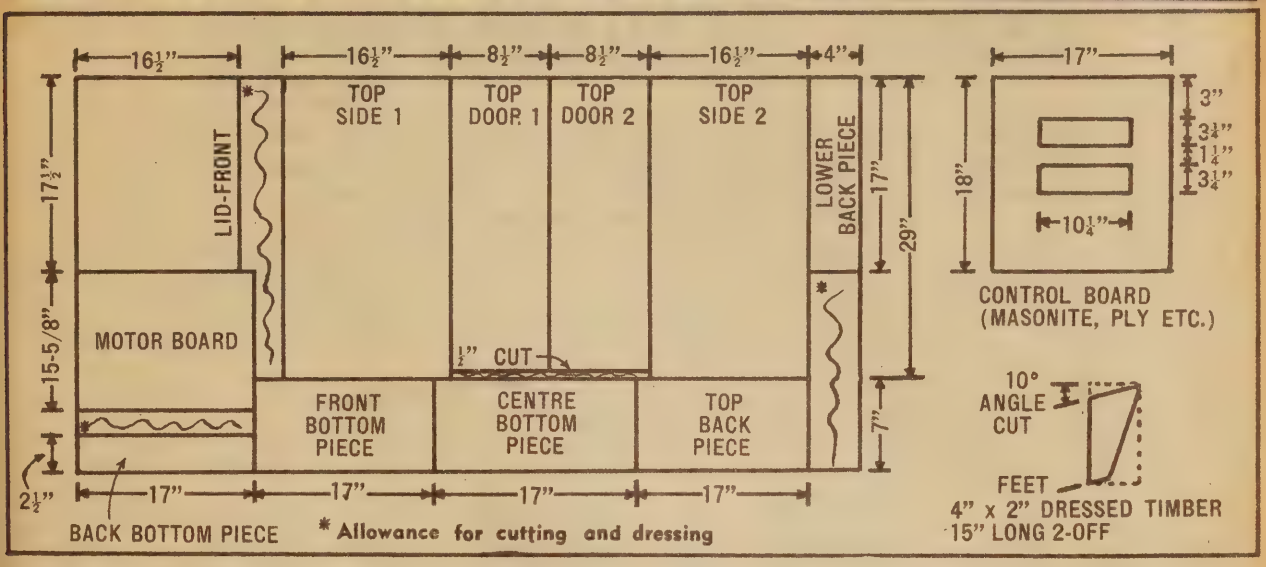

The diagram on the left shows how a 6ft by 3ft sheet of plywood can be cut up with practicaly no waste. Use the sides and doors in the sequence shown to preserve continuity of the grain. Details of the legs and control board are also shown.

continuity of grain may be preserved in the cut pieces. Needless to say dents, scratches and chips in the ply surface are to be avoided if a professional finish is to be obtained.

The opposite side of the ply is generally finished in ordinary pine or other timber of inferior quality, but, with careful selection, a reasonable surface may be obtained. The reverse side is visible as the inside of the doors and motor compartment.

If you are not equipped for carrying plywood, it is safer to have it delivered. Any damage to the ply surface will cause a considerable amount of inconvenience and will detract from the appearance of the finished unit.

Should you be unfortunate in that respect, do not despair for, with patience, most damage may be remedied. Chips may be glued back into place; dents may be steamed out by soaking the affected part with water and steaming with an ordinary household iron, preferably through a moist cloth.

Scratches are unfortunately, less easy to mask and may tend to show up, even when filled with an appropriate filler.

HARDWARE

While at the hardware store, consider the remaining odds and ends needed to complete the cabinet. You may purchase the feet in several styles or you may follow our lead and cut them from a piece of timber.

Several varieties of handles are available and the choice may well be left to the builder. Hinges should preferably be of brass and measure 2 x ½ inches. Panel pins and glue are used to hold the cabinet sides together, while the various cleats are held by screws.

Having purchased the necessary materials, proceed to mark out the ply in preparation to cutting. For your guidance, we have reproduced a cutting guide and no difficulty should be experienced in following this.

The sizes given are the finished dressed sizes and allowance should be made for saw cuts and dressing.

Power tools would assist beginners in obtaining a truer finish but a creditable job may be done with hand tools.

Take particular note of the layout showing the two sides and the doors of the cabinet. As indicated in the diagram, provision is made for a continuity of grain right around the cabinet. (Our prototype was not perfect in this respect, but yours can be, if you follow the plan.)

When cutting the ply, a fine toothed saw is ideal in preventing chipping of the edges. For the same reason, set the planer blade for minimum cut when planing.

The assembly of the cabinet could well begin with the sides and the bottom. Simple butt joints reinforced by 1-inch square cleats is the form of construction adopted by us.

Take one side at a time, marking the position to be occupied by the cleat, then glue and screw the cleat into place. The cleats will now act as a guide when fixing the bottom panels into place. The bottom sections should be glued into place, held securely by panel pins driven through the sides into their edges and then reinforced by screws through the cleats.

Do not overlook the fact that the cleats will have to be set back by an appropriate amount to allow for the front panel with its covering material, the control knob and the doors.

Whilst working on the cabinet, take particular care to see that the work area, whether it be the kitchen or the garage floor, is ffee from grit particles and other matter injurious to the ply surface. If necessary, use a sheet of hardboard or similar material to work on. (Your hardware store may have some heavy cardboard which has been used to package the original plywood bundle.)

Having assembled the sides and the boottom, the next step is to attach the rail that supports the motor board and also braces the two sides. In the position shown, this rail should provide clearance for most motors, but don't take it for granted. Work out how your motor and pickup can mount in the available space and see whether the underneath works are likely to foul the rail.

In such a case it may be possible to rotate the motor until the desired clearance is obtained. Should this not be feasible, then the rail will need to be moved forward and possibly made narrower.

An extra cleat, lower down, would then be required to support the front panel, allowing a certain amount of discretion in the position of the panel. It could be mounted on a slight incline or upright as desired, and in keeping with the clearance required for the motor.

The motor board should be a neat fit on three sides but the front must be cut back to provide clearance for the doors. It may be permanently attached but is best screwed to supporting rails and cleats for possible future removal.

SUPPORT CLEATS

A rail identical to the one under the front of the board should be fitted under the rear. Cleats measuring 1 x 1 inch should do for the sides. The rear rail should be attached ¼-inch from the side edge to allow for the back panels.

The back, made up from two left-over pieces, may now be attached. These pieces fit between the sides and are held by glue and panel pins. The lower piece slightly overlaps the rear rail and may be screwed and glued to it.

Take great care when cross-cutting the front and rear rails. The cuts should be exactly square, otherwise the sides may be pulled slightly out of position.

When performing the various glueing operations, take care not to allow any excess glue on to good surfaces since this will prevent the stain from being absorbed and will produce patches in the finish.

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PF299	240	285-0-285	40	6.3V-2A, 6.3V-tapped 5V-2A
PF300	240	325-0-325	40	6.3V-2A, 5V-2A
PF201	240	225-0-225	50	6.3V-2A
PF1459	230, 240, 250	250-0-250	60	6.3V-2AC.T., 6.3V-tapped 5V-2A
PF151	230, 240	285-0-285	60	6.3V-2AC.T., 6.3V-tapped 5V-2A
PF1388	230, 240	300-0-300	60	6.3V-2AC.T., 6.3V-tapped 5V-2A
PF166	230, 240	325-0-325	60	6.3V-2AC.T., 6.3V-tapped 5V-2A
PF165	230, 240	385-0-385	60	6.3V-2AC.T., 5V-2A
PF1460	230, 240, 250	250-0-250	80	6.3V-2AC.T., 6.3V-tapped 5V-2A
PF1428	230, 240, 250	250-0-250	80	6.3V-2AC.T., 6.3V-0.6A
PF170	230, 240	285-0-285	80	6.3V-2AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF1073	230, 240	300-0-300	80	6.3V-2AC.T., 6.3V-1A
PF169	230, 240	325-0-325	80	6.3V-2AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF168	230, 240	385-0-385	80	6.3V-2AC.T., 6.3V-2A, 5V-2A
PF1509	200, 230, 240	140 *	100	6.3V-2AC.T., 6.3V-2A
PF130	230, 240	285-0-285	100	6.3V-2AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF164	230, 240	325-0-325	100	6.3V-2AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF160	230, 240	385-0-385	100	6.3V-2.5AC.T., 6.3V-2A, 5V-2A
PF1072	230, 240	300-0-300	120	6.3V-4AC.T., 6.3V-tapped 5V-2A
PF152	230, 240	285-0-285	125	6.3V-3AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF163	230, 240	325-0-325	125	6.3V-2.5AC.T., 6.3V-2A, 6.3V-tapped 5V-2A
PF181	230, 240	385-0-385	125	6.3V-3AC.T., 6.3V-3A, 5V-2A
PF1508	230, 240, 250	250-0-250	150	6.3V-4AC.T., 6.3V-tapped 5V-2A
PF174	230, 240	285-0-285	150	6.3V-3AC.T., 6.3V-3A, 6.3V-tapped 5V-3A
PF142	230, 240	325-0-325	150	6.3V-2AC.T., 6.3V-2A, 6.3V-tapped 5V-3A
PF175	230, 240	385-0-385	150	6.3V-2AC.T., 6.3V-2A, 5V-3A
PF173	230, 240	425-0-425	175	6.3V-3AC.T., 6.3V-2A, 5V-3A
PF1335	230, 240	305-0-305	180	6.3V-4AC.T., 6.3V-4A, 5V-3A
PF1067	230, 240	400-0-400	180	6.3V-2.5AC.T., 6.3V-4AC.T., 5V-3A
PF1412	230, 240	300-0-300	200	6.3V-3.5AC.T., 6.3V-3A, 5V-3A
PF172	200, 230, 240	500-0-500	200	6.3V-4AC.T., 6.3V-3A, 5V-3A
PF814	200, 230, 240	1000-0-1000	200	5.5V-0.3A
		or		
		750-0-750	250	
		or		
		500-0-500	300	
PF179	200, 230, 240	475-0-475	225	6.3V-4AC.T., 6.3V-2A, 5V-3A
PF171	200, 230, 240	385-0-385	250	6.3V-4AC.T., 6.3V-3A, 5V-3A
PF107	230, 240	585-0-585	250	6.3V-3A, 6.3V-3A, 5V-3A
PF1193	200, 220, 240	295-0-295	275	6.3V-9A, 6.3V-tapped 5V-3A
PF1193V	200, 220, 240	295-0-295	275	6.3V-9A, 6.3V-tapped 5V-3A
PF1448	230, 240, 250	115*	300	12.6V C.T.-5A

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CABINET FOR PLAYMASTER—Cont.

The lid is deliberately cut under size so that strips may be glued to the sides to mask the edge grain. It may be difficult to obtain timber of the right dimensions to cover the edges and the best way out appears to be to glue an oversized stock and to plane this down to the required finish. If using maple ply, try to obtain maple for the edge.

The lid may now be hinged, followed by the doors. Care has to be taken to keep the hinges square, otherwise the doors will bind. If care has been taken in the assembly of the cabinet, however, no difficulty should be experienced in hanging the door true and square.

Let the hinges into the wood sufficiently to prevent a gap between the doors and the sides of the cabinet, but, not too deeply so that the doors and sides meet prematurely and force the hinges out of place.

DOOR CATCHES

It will be necessary to fit some form of catch to secure the doors in the closed positions. Most of the cupboard type catches are too bulky and will add little to the appearance. We used ball catches and suggest that you do likewise. These catches may be fitted to the bottom edges of the doors and concealed, the only visible portion being the clicker plates, which are not very conspicuous.

To complete the overall construction, it will be necessary to fit cleats to hold the front panel and cleats to hold the rear panel, if you decide to fit one.

The front panel may be cut from masonite or 3/16-inch ply. Cutouts to take the tuner and control unit should be suitably located and reinforced by rails attached directly below the cutouts and parallel with the lower edges. These rails are made to serve a dual purpose of reinforcing the front panel and of supporting the tuner and control unit.

The timber for these rails may be any convenient size, approximately 3 x 1 inches being about optimum, glued and screwed edgewise to the rear of the panel.

Some method of anchoring the control unit and tuner is necessary. We settled on ½in aluminium straps, bent to hug the control unit box sides and top. The lower ends of the straps are bent out and screwed to the rails, while the top ends are bent up so as to form a slight gap. This gap is narrowed as the two ends are drawn together by means of a nut and bolt, thus clamping the control unit box securely in place.

FINISHING PANEL

Prior to fitting the tuner and control units into place and mounting the whole, it will be necessary to finish the panel.

It could be polished, but the alternative, which many will prefer, is that of covering it with a material to suit the furnishing scheme in the listening-room. Our cabinet was covered with a vynex type of material which is available in a variety of colours and pattern finishes. Speaker enclosure covering materials are also suitable. In fact, an infinite variety of materials suggest themselves for use either as the front panel or as the covering medium.

Whatever you use to cover the panel abide by the manufacturers' recommendation regarding the adhesives to use, etc. For vynil-coated fabrics we have found contact cement to be ideal.

You may make the panel a permanent installation if you wish, or you may do as we have done and provide for its easy removal. To this end it will be necessary to file two small cutouts in the lower edges of the panel to clear the door hinges which overlap the inner sides of the cabinet. It will not be necessary to do likewise in the covering material as this may be draped over the cutouts to form an unbroken edge and will not detract from the appearance.

"TYPICAL COMPLETE PLAYMASTER"

Readers' attention is drawn to a slight error which occurred in the amplifier circuit on page 65 of our last issue. The plate-plate load of the EL84 output valves should read 8000 ohms, not 4500 ohms as shown.

In clearing the hinges the covering material is compressed into the cutout, but will spring back into place once the hinges are cleared.

The panel may be attached by means of upholstery tacks in the case of a permanent installation or by nickel-plated screws and cup washers in the alternative case. Do not forget to reduce the overall dimension of the panel by the thickness of the covering material if a neat fit is to be obtained.

Last, but not least, is the finishing off of the cabinet. Once again, this process is rather flexible in that it may conform to indivdual requirements.

FINISHES

A variety of lacquers, plastic finishes, etc., are available to the home constructor, the selection of which will be largely a matter of individual preference. Staining of the surfaces may be found necessary to match existing furniture and whatever the stain selected we suggest that you experiment on scraps of timber —in this case maple—to obtain the right shade.

A word about the selection and application of stains may not be out of place at this juncture. We used Taubmans Penetrol, which proved particularly effective in our case. Some stains we have tried proved too tricky in application, while others seemed inconsistent from container to container and with reference to the published colour charts.

Other stains appear to rely unduly for their success on the use of an appropriate filler. Still others are of the varnish type and unsuitable for the job.

There are also spirit and water stains available and those experienced in their use may prefer them.

In applying stain we have found that it is far better to rely on several applications of a lighter stain, to obtain a desired shade, than a sparing application of a darker stain. Likewise, several light applications give a greater degree of control over the final shade than one heavy application.

To apply the stain evenly, pour some of it into a shallow dish, then dipping a wad of lint free cloth proceed to rub it into the grain.

Filling of the ply surface proved unnecessary in our case. Extremely porous surfaces, however, will require filling and great care must be exercised in its application.

The punched panel pin holes should be filled with putty after the application of stain and preferably when the stain has dried thoroughly. The putty may be coloured to the correct shade with a small quantity of stain worked into it. Avoid smearing of the putty over the surface adjacent to the holes as it will tend to discolour the surface.

SEVERAL COATS

With normal surfaces, filling may be dispensed with and it should be sufficient to rely on two or three coats of lacquer, each preceding coat being sanded back, to produce a smooth finish.

Three coats will usually do the trick, the final one being rather heavy. To apply a heavy coat successfully and avoid runs, coat one surface at a time and leave it in the horizontal position until dry.

To mask the edge grain on the front edges of the lid, motor board, cabinet bottom, the doors and the sides, we adopted the simple expedient of painting them. Any of the usual variety of household paints should be suitable, the colour chosen in our case being a mid-chocolate brown.

To add a professional touch to the appearance of the cabinet, we also added a metal mould. This mould is available but presents marketing difficulties in that it is not easily packaged. It is imported by Colan industries, whose factory representatives in N.S.W. and Victoria are R. W. Steane and Co. It will be made available to any trade house interested in handling it.

When fitting this mould, it is necessary to groove the front edges of the cabinet. A groove made by a general purpose circular saw as fitted to most drill attachments is quite adequate. The mould may be held in place with contact cement.

It now remains to fit the legs to complete the cabinet. As mentioned previously, you may wish to purchase a ready-made set; alternatively, you may follow our example and build a set.

CABINET LEGS

A developmental drawing of the legs is shown for your guidance. The legs are shaped from a piece of 4 x 2in timber, each leg being 15in long. We suggest that you cut and shape a 30in length, so that both legs will be identical when later cut in half. The legs may be painted or stained and lacquered, as you choose.

The addition of a further refinement, which we have felt to be almost essential, should complete the cabinet. This consists of masking the rear inside face of the pickup compartment. We used the process identical to that on the front panel—a piece of hardboard, covered with vynex and attached to the back by means of upholstery tacks.

The purpose of this mask is twofold; that of hiding the join in the back piece and of continuing the motif established by the plastic covering on the control panel.

Jacoby Mitchell...

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D.C. Current	0-300/uA, 0-300mA	0-50/uA, 0-7mA, 0-140mA	0-30/uA, 0-300/uA, 0-3mA, 0-30mA, 0-300mA, 0-1.2 A, 0-12 A
A.C. Current	——	—	0-1.2 A, 0-12 A
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Capacitance	0-0.1/uF 0-20/uF	0-0.03/uF 0-0.6/uF	0-.02/uF, 0-.2/uF, 0-4/uF, 0-100/uF 0-2000/uF
Inductance	0-1000H	0-5H 0-500H	0-1H, 0-20H, 0-800H, 0-10,000H Mutual Conductance 0-12,000/umhos
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0-6-30-120-300-600	0-7-35-140-350-700	0-.24-1.2-3-12-30-60-120-300-600	0-6-30-120-300-1200
0-6-30-120-600	0-7-35-140-700	0-3-12-30-60-120-300-600	0-6-30-120-300/1200
0-300/uA, 0-12mA, 0-300mA	0-100/uA, 0-1.4mA, 0-140mA	0-30/uA, 0-300/uA, 0-3mA, 0-30mA, 0-600mA, 0-12 A	0-1.2mA, 0-300mA
—	0-200/uA	0-600mA, 0-12 A	—
0-20K, 0-2 Meg., 0-200 Meg.★	0-50K, 0-5 Meg.	0-2 Ohms, 0-1K, 0-10K, 0-100K, 0-1 Meg., 0-100 Meg., 0-1000 Meg.★	0-10K, 0-1 Meg., 0-100 Meg.
0-0.1/uF, 0-20/uF	0-1/uF, 0-100/uF	0-0.02/uF, 0-0.4/uF, 0-10/uF	0-0.1/uF, 0-2.0/uF
0-1000H	0-1000H	—	0-1000H
-15 to +58	-15 to +59	-00 to +58	-15 to +64
'S' Meter scale Tube Emission	Tube Emission GM Mirror Scale	Mirror Scale 'S' Meter Polarity reversal	'S' Meter scale Inbuilt Lamp—single handed operation.
	VIG Probe EHT Probe 0/17.5kV Cap/Ind Adaptor	VIG Probe HV Probe 3kV D.C., 6kV A.C.	

★ **External voltage necessary for these ranges**

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A FULLY PROTECTED MULTIMETER

Following last month's discussion on meter protection, we now consider the practical aspects of fitting such protection to a typical multimeter. In addition, we discuss means of protecting the diodes themselves, and the changes necessary in the circuit to allow this to be done.

by Philip Watson

WHILE we feel that most readers will want to incorporate these features in their existing meters, our remarks are equally directed to those who have been contemplating the rebuilding of their old multimeter for other reasons.

If "old faithful" is looking somewhat the worse for wear, and possibly not as convenient to use or as accurate as you would like, this could be the ideal time to do something about it.

A revision of the circuit to discard any old-fashioned ideas, plus the protective scheme about to be described, will take care of most of the electrical problems. A new front panel and, possibly, a new metal case, will work wonders with the appearance and the finished meter will be something unique in home-made multimeters.

PROTECTING DIODES

In last month's article we were able to show how a pair of silicon diodes can effectively protect most meter movements, even under very severe conditions of overload.

In fact, once these diodes are fitted, the problem becomes that of protecting the diodes rather than the meter. The diodes, if subjected to extreme overload, will break down, but will "fail safe" in the process by creating a virtual dead short across the meter.

This is a good deal cheaper and more convenient than having to send the meter back to the makers for repair, since a diode will cost about 14/ (only one is likely to be damaged at a time) and may be replaced in a few minutes, as against several pounds and a period of days, or even weeks, required for a meter repair.

However, anything we can do to provide protection for the diode will make the scheme just that much more attractive, since we may be saved even this relatively minor cost and inconvenience. It is along these lines that our latest activities have been directed.

The main hazard is a high voltage low impedance power supply of any kind, the main HT line in a radio or TV receiver being a typical example. By reason of the last electrolytic, which may range up to 100 mfd, such a supply has, momentarily, almost zero internal impedance.

This means that the initial surge of current it is able to deliver is limited almost entirely by the resistance of any circuit connected across it. Since our protective diode may have a resistance as low as one ohm under these conditions, a 250-volt HT line could conceivably deliver a surge of 250 amps—many times the most generous surge ratings of these diodes.

NOT SATISFACTORY

For reasons we discussed last month, fuses do not appear to be a satisfactory answer to the problem, at least with currently available types. However, we did suggest that it might be possible to add a limiting resistor which would protect the diode in most circumstances, provided this did not call for too many changes in the basic circuit.

However, the exact details regarding the amount of resistance which could be tolerated or whether, in fact, any could be tolerated, and the amount of protection likely to be afforded still had to be worked out and tried on the bench.

We took as a basis for experiment a value of 100 ohms to be added directly in series with the combination of meter and protective diodes. One advantage of this value is that it exactly doubles the usual figure of meter resistance, and also (for all practical purposes) doubles the value of the shunts required. We felt that this may simplify the provision of such shunts.

MUCH REDUCED

Turning to the diode we find that the greatest surge now possible from a 250 volt HT line has been reduced to 2.5 amps, while even a 500 volt supply cannot produce more than 5 amps.

The actual surge which these diodes can withstand is dependent to a large degree on the time involved. Typical ratings go as high as 35 amps for a period of 2 milliseconds (mS), while other types are listed rather more conservatively at 7.5 amps Maximum Instantaneous Peak Current without any time being quoted. However, a graph in the same data sheet shows that 7 amps (the maximum value shown on the graph) may be tolerated for the relatively long period of 20 mS.

While somewhat inconclusive, these figures suggest that a surge of five amps as mentioned above, should be safe for periods of two or three mS, even on a fairly conservative basis.

Which raises the question of just how long a surge from a typical HT line is likely to last. A simple formula, T equals R x C, enables us to calculate the time required for a capacitor to discharge to 37 p.c. of its original voltage. In our case we can conveniently express R in ohms, C in mfd, and T in uS (microseconds).

COMPLEX EFFECT

(This time will be modified by the fact that the capacitor still is being charged by the power supply while being discharged through the meter. However, the impedance of the charging source normally would be high and should not seriously affect these calculations, remembering that they are intended purely as a guide anyway.)

Assuming a HT line at 250 volts, a 32 mfd final filter capacitor and a 100 ohm limiting resistor, we can calculate that this should drop to 92 volts in 320 uS or 3.2 mS. By the same reasoning the current would drop from 2.5 amps at the moment of contact to .92 amps in the same period. This would seem to be well within the rating of 2 amps for 20 milliseconds, since the maximum figure is well below the 7.5 amps previously stated.

A more extreme case would be a T

EDITOR'S NOTE

The multimeter circuit on the opposite page is interesting in itself, being the result of work which was largely original as far as we were concerned.

It probably represents the first multimeter design for home construction, which features complete in-built overload protection.

The principles are important, however, over and above this present application, since they can be applied to almost any meters which, by nature, are subject to possible overload.

One such application suggested to us by a manufacturer was the protection of meters in production testing bridges, which can be overloaded seriously when one arm is accidentally opened or loaded by a faulty component.

In such a case, where linearity to either side of the balance position may not be vital, very effective protection could be given by swamping the meter to bring its FSD voltage closer to the threshold of the protecting diodes.

Such a method would be simpler and less liable to drift than one in which isolation was secured by the VTVM principle.

set with a 100 mfd final capacitor. This would require 10 mS to drop to 37 p.c., but even this may not seriously transgress the ratings. Summing up, it would seem that a 100 ohm resistor will protect the diode from the surges likely to be delivered by most receiver HT lines.

Having arrived at this conclusion on paper, we put the idea to a practical test. Using a 300-volt power supply from a large amplifier (the same one that delivered a death blow to a diode during last month's experiments), we flicked this across the meter/diode combination to which had been added a 100 ohm limiting resistor.

The pointer plinked against the stop in a manner which we have now come to accept as harmless, but that was all. The diode obviously hadn't broken down or been damaged in any other way and withstood several further applications equally well. At least we were that much better off than last month.

TOUGH TEST!

Finally we decided to make a really tough test. We added a 100 mfd. capacitor across the 300-volt HT line, to simulate the conditions likely to be encountered in a TV set. When the system withstood this we felt that we had achieved what we had set out to do; produce an almost non-destructible home-made multimeter.

We say "almost" because there still are some conditions which might prove too much for the diode, even though the meter should remain protected. One we can envisage involves an AC supply, such as the secondary of a large power transformer, or even the mains.

Not only can the impedance of such a supply be very low but, unlike the capacitor, it remains low. Thus the fate of the diode may well depend on how long the overload is allowed to continue. If it is only a flash application no harm may be done, but even a second may be too long in many circumstances.

However, these are extreme conditions, certain to wreck an unprotected meter almost beyond repair, so the cost of a diode is a small price to pay.

Another hazard is the AC ranges. Here the rectifier probably will be the weak link, and is likely to be wrecked if seriously overloaded. It may be possible to devise a protective circuit for this, using two more diodes, but there is some doubt as to the advantage of such an arrangement, since the diodes would cost nearly as much as the rectifier, and may be nearly as vulnerable in that part of the circuit.

EXTREME CONDITIONS

Having established that a limiting resistor was very definitely worthwhile, the next question concerned its possible effect on meter accuracy. While our investigations were confined to one of our own circuits, this follows fairly standard practice and the remarks should apply to most similar circuits. We might add that the points about to be discussed have been confirmed in practice.

A close tolerance resistor is required for the 100 ohm diode protector, preferably a 3-watt wire-wound 1 pc type. In addition it is fairly obvious that new shunts will be required for the current ranges, since we have doubled the meter resistance. Since these are non-standard values, they looked as though they might present a supply problem.

One solution is to simply buy a second set of 100 ohm shunts and connect these in series with the existing ones. This should be satisfactory in the electrical sense, but may present physical problems, due to limited facilities to mount the extra shunts.

A second idea is to wind a new set of shunts, and this is a perfectly satisfactory arrangement for those who have a standard and other facilities available.

Finally, we understand that at least one manufacturer is willing to make such a set of shunts available, and these should be available through trade houses under the "Jabel" brand.

Other manufacturers may, of course, follow suit.

Next, we may consider the resistance ranges. Analysis of the basic circuit will show that it is essentially a battery, meter, and current limiting resistor in series, plus the unknown resistor. The current limiting resistor value is determined by the meter sensitivity and the battery voltage, and is 1,400 ohms in a typical circuit.

It does not matter particularly how this value is made up, and the addition of the 100 ohm diode protection resistor simply means that the original

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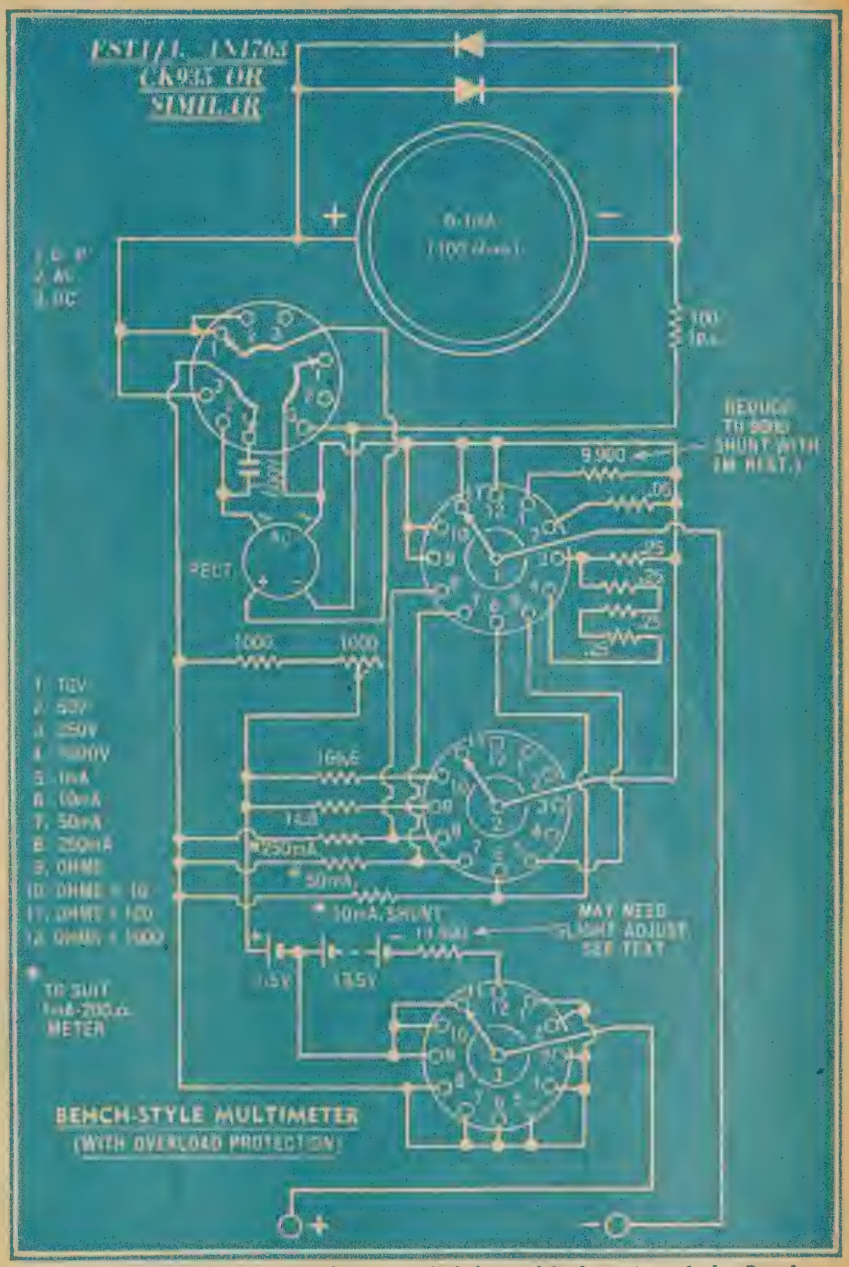

Many readers will recognise this as a slightly modified version of the Bench Type Multimeter and other multimeters we have described. Only a few simple changes are required, and the circuit also will provide a basis for the modification of other meter circuits, most of which may be protected in a similar manner.

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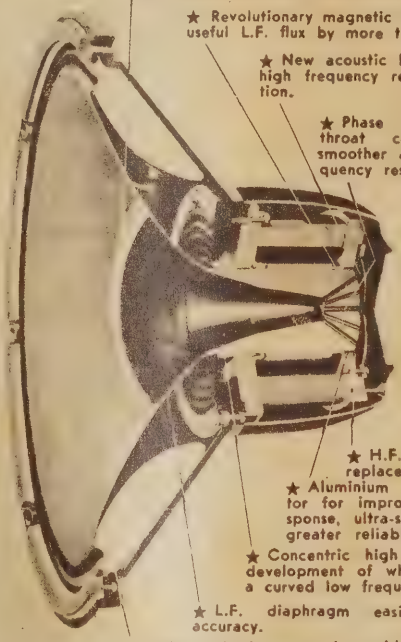

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resistor will need to be reduced by this amount. In most cases the variable section representing the "Zero Adj." control will have enough range to take care of this.

Nor will it be necessary to alter the 14.8 ohms and 166 ohm shunts used to provide the two lower resistance ranges. These are connected in parallel with the meter and current limiting resistor, and are calculated on the basis of a total resistance of 1,500 ohms. (1,400 ohms external resistor, plus 100 ohms in the meter in a normal case.) The fact that the total of 1,500 ohms is now made up from 1,300 external resistor, plus a 200 ohm meter, will not alter the shunt values in any way.

An exception might occur in the case of the highest range. This has a limited zero adjustment in any case, and the extra 100 ohms may prevent correct zero adjustment either when the battery is new, or when it has aged only slightly and otherwise still good. Ideally the control should be almost fully anti-clockwise with a new battery, thus giving maximum range to allow for falling voltage.

If this cannot be achieved, the 13,500 ohm resistor should be reduced in value until it is. The exact value is best found experimentally, but shunting it with something between 1m and 1.5m should serve as a basis for trial. It does not need to be a close tolerance type and will not affect the accuracy in any way.

VOLTAGE RANGES

Finally we may consider the voltage ranges. The extra 100 ohms will not affect these to any serious degree, the multiplier resistance values being so much higher by comparison.

The only range affected to any extent is the 10 volt range, and this will read low by a mere 1 p.c. Even this small error can be overcome quite easily by shunting the multiplier with a 1M resistor. Again, a close tolerance type is not necessary. The AC ranges use the same multipliers, so are taken care of automatically.

These are the only alterations likely to be required in modifying a circuit of this kind to that of a well protected instrument, and the accompanying circuit should provide any details not immediately clear from the text.

Circuits employing higher sensitivity meters will have to be treated on their merits, although, in general, what we have said should apply equally to them.

Two points will need to be considered; the suitability of the diodes for use with the meter, and the effect of the diode protective resistor on the remainder of the circuit. The first point was discussed last month; the second will depend on the circuit. New shunts still will be necessary, but this resistor will have even less effect on the voltage multipliers.

Regardless of the type of instrument, the cost of the additional components is relatively small, very little work is involved, and, assuming the availability of ready-made shunts, it should not even be necessary to recheck the ranges after the work is done. All things considered, it would seem to be a very worthwhile modification; an almost ideal answer to a tricky problem.

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TRADE REVIEWS AND RELEASES

LOW PRICE CRO PERFORMS WELL

A new Australian made oscilloscope recently announced is the "Portascope 300," made by BWD Electronics of Hawthorn, Vic. Designed to provide the greatest number of facilities at the lowest cost, the instrument has many features normally found only in more expensive instruments. It would appear to be an excellent instrument for the small laboratory or TV service shop.

THE cathode ray tube used is the 2½in, type DH 7/91 or 3AFP1, and is fitted with a calibrated graticule and light filter combined. Two-inch deflection is possible, both horizontally and vertically, and accurate measurements of time and voltage may be made with ease.

The vertical amplifier response at the maximum input sensitivity of 100 mV P-P/Div is given as from DC to 1 Mc and extends from DC to 10 Mc at 10 V P-P/Div within 3 db. A 3-1 vernier control extends the maximum input signal to 30 V P-P/Div.

A special feature is the balanced input facility. This enables examination or measurement to be made of signals appearing between two points, neither of which is at earth potential, or across components not isolated from the mains. Such might be the signal across the push-pull primary of an output transformer or across the frame scanning coils in a TV receiver.

The controls are well laid out, and the general finish is good. Checks in our laboratory indicate that the manufacturers' claims are justified. Considering its moderate price we feel this to be a very attractive instrument. Price is £86/5/, plus sales tax. F.O.R., Sydney. Further details from the manufacturers or the N.S.W. agents, Messrs. Jacoby Mitchell Pty. Ltd., 469 Kent Street, Sydney.

TWO NEW ROLA 8M SPEAKERS

Recently announced by the Rola Co. (Aust.) Pty. Ltd., are two additional models of the well known 8M speaker, the 8M10/59/15 and the 8M10/63/15. Both are similar to the previous models in size style, and performance, the main difference being the use of a 15 ohm voice coil.

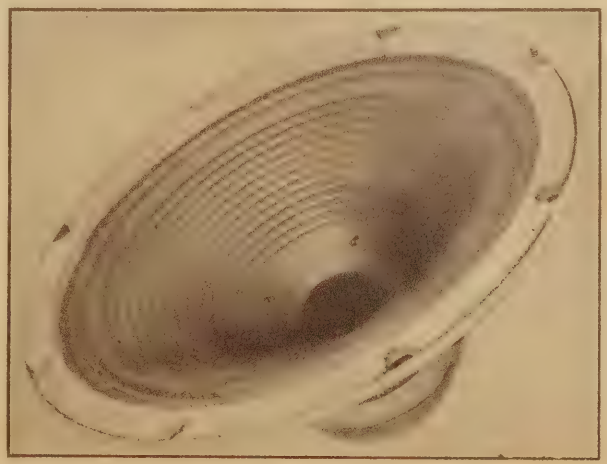
THIS is particularly useful in small PA systems, where the cost and complexity of a 500 ohm transmission line is not warranted, but where losses may be excessive with a 2 ohm voice coil. Alternatively this impedance often is more suitable for use with some high quality output transformers.

The 8M10/63/15 uses an F63 type cone with a resonance at 125 cps. It is intended for use in PA systems. The 8M10/59/15 uses an F59 type cone with a 75 cps resonance, and is intended for normal radio applications.

The price (£3/3/) is the same as that for the 2 ohm models. The latter are still available for those requiring them.

In all impedances the 8M is the most sensitive in the 8in. Rola range, making it ideal for use with small PA amplifiers or battery operated receivers.

Further details from Rola (Aust.) Pty. Ltd., The Boulevard, Richmond, Victoria.



GS12-GS15 SILICONE GREASES

GENERAL SILICONES PTY. LTD., announce the availability of two silicone greases for the benefit of radio, TV and allied industries. These are GS12 Gensilec Silicone Insulating Compound and GS14 Gensil Rust Inhibiting Grease.

Both are described as smooth translucent silicone greases with the consistency of petroleum jelly. They have a high order of water repellency, work over a temperature range from minus 50 degrees C to plus 200 degrees C with very little change in consistency and do not harden or crack.

GS14 is mainly useful as a protective coating for metals. Nuts and bolts, screws, rivets and similar parts, dies and moulds, castings, etc., which have to be stored for any length of time are typical of what might be encountered in the radio and allied industries.

GS12 is an insulating compound useful for waterproofing electrical equipment. It may be used as a potting compound, as a protective coating around the anode terminal of TV picture tubes, and on TV aerials in salt-laden atmospheres. It also may be used to improve the heat conductivity between a transistor and chassis, even though these must be electrically insulated.

Further details from the N.S.W. agents, Jacoby Mitchell and Co. Pty. Ltd., 469 Kent Street, Sydney.

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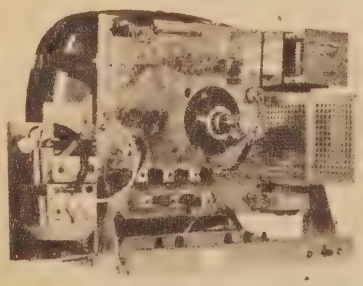

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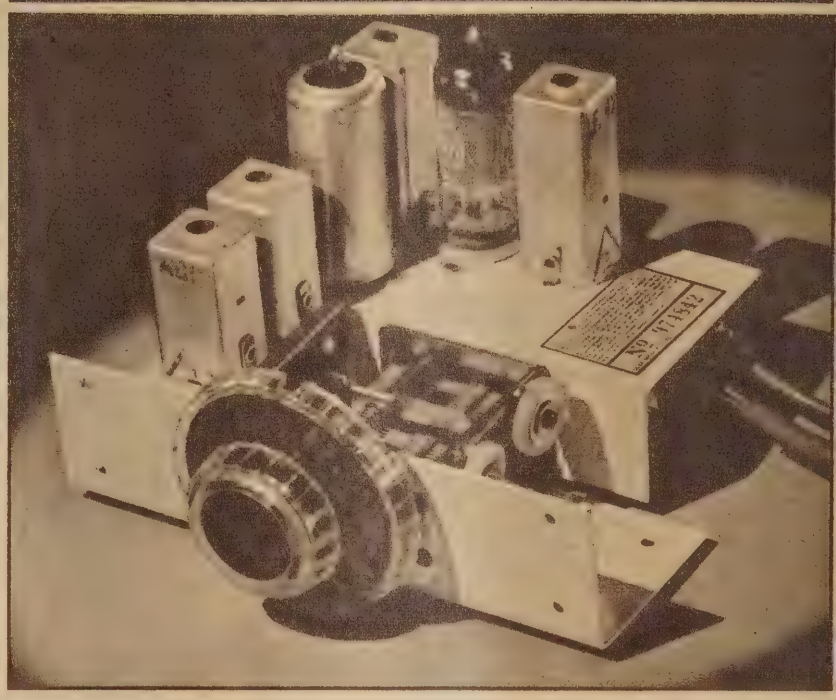

Of interest to the amplifier enthusiast is this compact tuner marketed by Servo Mechanism Co. of Victoria. Requiring very little room in the amplifier cabinet, it may be mounted either vertically or horizontally or built on to an existing metal panel if desired.

THE makers advise that it is suitable for amplifiers having a sensitivity of 1 volt or better, requires a HT of 200 to 350 volts at 6mA, has ample sensitivity and selectivity, and features a two-speed tuning dial.

A sample model tested in our own workshop performed very well, and appeared to substantiate all the maker's claims for it.

Further details from the makers, the Servo Mechanism Co., 505 Lygon Street, East Brunswick, Victoria.

"TYGAN" HIGH FIDELITY FABRIC

One of the problems associated with the design of acoustic furniture is to provide an attractive covering for the various speaker openings, without impairing the volume or frequency response of the system.

TO overcome this problem, Colan Industries Pty. Ltd. are now making and marketing, under licenee from Fothergill and Harvey Ltd., England, the high-fidelity fabric, "Tygan."

"Tygan" fabric has been used extensively throughout Britain, Europe and the United States for several years and has gained a high reputation, both for appearance and acoustic quality.

The fabric is woven from strands or filaments of P.V.D.C. plastic, to which is added small quantities of rayon and Lurex (metallic thread) for decorative purposes. An open weave is used to provide acoustic transparency, but the method of weaving and the patterns employed are such that this open weave is not apparent except on close inspection. As normally viewed, it resembles a standard weave.

The appearance is enhanced by the rigid nature of the P.V.D.C. filaments, which minimises any tendency to sag, as is common with other materials. Also in the interest of appearance, there is a very wide range of patterns from which to choose, making it a simple matter to suit virtually any cabinet style or colour.

The acoustic transparency appears to be very good and the makers claim that independent tests have shown that there is no significant absorption over the audio range. It appears to be an ideal material for this rather exacting requirement.

It is available in 54in wide rolls for manufacturers and wholesalers, but arrangements are being made to market small quantities for individual users. These will measure approximately 36in by 27in and should be ample for most speaker cabinet projects. The exact price is yet to be fixed, but is expected to be about 29/6 per package.

It will be available through trade houses.

Further details from the makers: Colan Industries Pty. Ltd., 63 Eustace Road, Alexandria, N.S.W.

TECHNICAL BOOK REVIEW

A.B.C.'s OF TRANSISTORS, by George B. Mann. Publisher, Howard W. Sams and Co., New York. Soft cover, 5½in x 8¼in, 96 pages. Illustrated by very clear circuit diagrams and some photographs.

Today's electronics technican or student must know transistors as well as he knows vacuum tubes, so there is a need for a basic, easily understood volume on the subject.

Such a book will not need to involve the reader in highly mathematical discussions or labyrinths of technical information and yet should not be so simplified so as to be of no practical value. Mr Mann has arrived at an excellent compromise with this publication.

The first two chapters deal with semiconductor fundamentals and physical construction. The next discusses basic circuits, both N.P.N. and P.N.P., bias arrangements and amplification and a summary of the characteristics of the three configurations.

Amplifiers and oscillators are next discussed, at first generally, then with reference to specific circuits. Both audio and R.F. amplifiers are included. A chapter on the effects of temperature follows, with some methods of compensation and dissipation.

The final two chapters are headed "Mechanics of Usage" and "Testing of Transistors." Here are discussed the problems of soldering, the effects of excess voltage and the wrong polarity, proper mounting, etc.

The section on testing is particularly good and includes the testing of both transistor circuits and individual transistors.

Our copy from Technical Book and Magazine Co., 295-299 Swanson Street, Melbourne. Australian price, 13/3, plus postage, 1/.

★ ★ ★

28 USES FOR JUNCTION TRANSISTORS. A manual of practical applications published by Sylvania Electric Products Inc., New York, 19 N.Y. 48 pages, 9in x 6in, soft covered booklet.

This is another of the many booklets published by the companies interested in the manufacture and sale of electronic components and as such is quite good. There are 28 projects to tackle, covering a wide field. They are all fairly simple.

The book is presented initially to meet the needs of technicians and hobbyists anxious to acquire a working knowledge of transistors, hence the theory has been held to a minimum. There is a brief introduction, then the projects.

These include amplifiers of all kinds, oscillators, control devices and instruments. The circuits have obviously been prepared for the American market since many of the components have been given specific part numbers, rather than general values. However an experienced worker should be able to find local equivalents in many cases.

Our copy from the Technical Book and Magazine Company, 295-299 Swanson St., Melbourne. Australian price is given as 7/6, 1/ postage. (J.W.B.)

RAPID RADIO REPAIR, by G. Warren Heath. Published by Gernsback Library, Inc., 154 West 14th Street, New York 11, N.Y. 224 pages, 5½in x 8¼in, with photos, circuit and drawings.

Despite the fact that television appears to have pushed radio generally into the background, there is still a large amount of radio servicing to be done. There is moreover an upswing in the numbers of semi-portable, portable, mains and/or battery and transistor sets being sold. Many of these, in particular the transistor sets, use new circuitry and methods of construction.

It is also necessary, in this rather competitive business, to be able to locate faults and clear them quickly. In this new, alphabetical guide to radio receiver servicing, Mr Heath covers all types of sets including f.m., hybrid auto, all wave and transistor receivers and has made an effort to include all symptoms of trouble and their cures.

The book is in four sections for quick reference: Receivers, Techniques, Servicing, Troubleshooting charts. The "Techniques" section covers general methods of alignment and checking of a wide variety of apparatus, in alphabetical groupings, and the "Servicing" section contains alphabetical listings of specific faults. A complex index enables quick location of faults, this information being general in character, rather than related to specific designs.

Our copy from the publishers. No Australian price is given, but the book should be available in due course from the publishers.

★ ★ ★

FREQUENCY MODULATION, by A. W. Keen, M.I.R.E., A.M.I.E.E. An introduction to fundamental principles. Published by Messrs. Pitman, London. Hard cover, 274 pages, 7¼in x 5in.

Since the beginning of experimental f.m. transmission in this country some years ago, the number of people interested in buying or building suitable receiving apparatus has increased considerably. Also the sound transmission in the television service is f.m., adding to the interest created.

Mr Keen has written this book in order to provide those who are seriously interested in the technicalities of the subject, a concise, but comprehensive descriptive account of both the transmitting and receiving sides of f.m. broadcasting technique. He assumes a fairly thorough familiarity with corresponding a.m. techniques.

He also tries to steer away from mathematical complexity as much as possible in the main text but includes an appendix wherein the main mathematics concerned are presented for interested persons.

Chapters of particular interest to the majority of readers are those devoted to detection of f.m. signals, interference and distortion considerations and general receiving equipment.

Our copy from Technical Book and Magazine Co., 295-299 Swanson Street, Melbourne. Australian price, 47/3, 1/9 post.

OSCILLOSCOPE TECHNIQUES, by Alfred Haas. Published by Gernsback Library, Inc., 154 West 14th Street, New York 11, N.Y. Soft cover, 224 pages, 8¼in x 5½in. Freely illustrated by oscillograms and circuits.

In recent years there has been an upsurge in the numbers of servicemen, technicians and home builders who have found the use of the C.R.O. not only attractive, but often necessary. More particularly in the field of television, efficient servicing is difficult and sometimes impossible without the help of such an instrument.

Many owners and users of oscilloscopes are familiar with some of the common uses of their instrument but are unaware of the other large number of functions it can perform, often with the aid of relatively simple auxiliary apparatus. Since oscilloscopes are generally expensive, it is only economic to see that they are used in as wide a variety of situations as possible.

For this reason, a book such as this can be a valuable asset. It is very practical and features hundreds of photographs of 'scope patterns with attendant explanations of their origins and what they indicate. There is an excellent section on oscilloscope accessories.

The first two chapters discus fully the cathode ray tube and the associated circuitry and there is a chapter on the means by which a 'scope may be used to check its own performance. Some odd effects can often be traced to faults in the instrument itself.

The remaining six chapters are devoted to methods of measurement and display and the analysis of a multitude of circuit performances. Our copy was from the publishers and the Australian price is not yet available. The book is apparently published also with hard cover.—(J.W.B.).

★ ★ ★

PRINTED CIRCUITS, by Morris G. Moses, W8UVC. Published by Gernsback Library, Inc. New York 11, N.Y., 1959. 224 pages, 5½in x 8¼in, profusely illustrated by photographs and circuits.

Not a great deal of literature has been available on the techniques of printed circuitry, especially for the technician and home constructor, so this publication will be very welcome. It is a veritable encyclopedia on the subject.

The book traces the development of the art and introduces us to commercial production techniques as well as to comprehensive methods of construction for the home constructor. There are two chapters devoted to component selection and application and a chapter on the repair of printed circuits and subminiature assemblies. This latter section will be of interest to servicemen.

The final two chapters present a large assortment of practical assemblies, some quite advanced. Our copy is an attractive paper back edition and the illustrations are clear and easy to follow. Our copy was from the publishers, but supplies should be available in due course from local technical booksellers. (J.W.B.)

foundations for such deplorable thin
to become established in this countr
As Mr Ivanov said at the I.T.U. co
gress, "human life seems to be valu
at the price of a cartridge."

"The English language, just as
comes from England, is a beautiful la
guage, with infinite variety, and mu
scope for expressing individuality.

"Perhaps the spelling of some wor
is (apparently) illogical and rather ha
to learn: nevertheless, I love the la
guage just as it is, and I deplore t
efforts made by various people (inclu
ing Mr Yashin) to foist the lazy Ame
can spelling on to this nation, which
part of the BRITISH Commonwealth.

"So be warned, I'm compiling
"blacklist" of business firms, magazin
etc., which attempt to sell their goo
on the basis of "sounding American
"R. T. and H." appears in the "suspec
column, much to my regret. Two mo
infractions, and out you go from m
reading list. And should you be so m
guided as to sponsor an "E-Z-bild" k
set, I'll come and smack you 150 tim
with a baseball bat. So there.

Yours hopefully, R.D."

So there it is.

The letter is addressed through t
Editor to Mr Yashin, our staff membe
who did the physical work of buildi
and testing the original unit and, lat
of writing the descriptive article.

Let's Buy An Argument

You must pardon me if I guffaw out loud at times or seem to suffer with periodic attacks of the chuckles. For these exhibitions of spontaneous merriment, I am indebted to a reader R. D. from Ryde, in N.S.W. Equally, of course, he may later turn the tables to have the last laugh on me!

by Neville Williams

WHAT with all this talk about laughing, I can't resist the query as to whether our correspondent has any connection with the famous team of Laurel and R.D.?

But enough of that. Though not primarily concerned with "radio" as a subject, the letter in question was inspired by an item of radio equipment, namely our "Program Source," as described in the November issue.

I quote the letter verbatim:

"Dear Sir,

"Let's buy an argument. At any rate, I'm ready to buy one with your Mr Wes Yashin. The reason? Mr Yashin's use of the term "PROGRAM Source" to describe the latest tuner (which, incidentally, performs very well).

"I'm very disappointed to find "R. T. and H." joining the ranks of the snide salesmen, smart Alec real estate agents, beatniks and sundry other persons (of low mental standard in my opinion) who are trying to foster the idea that nothing can have any merit unless it has some very obvious connection with American "culture."

"Now to forestall a possible counter-criticism, let me say that I am NOT a Communist and I fully realise, and respect, the position that the United States holds in the world today.

"However, I don't think that our feelings in that respect justify our aping of of speech and spelling, etc. nor of American customs, mannerisms, manner labelling every new business venture with the name of some American state.

"I'm Australian and proud of it, too, and I think it will be much to our credit in the long run to assert the fact that we are Australians, with our own way of life, rather than to become wishy-washy imitation yanks.

"There are many aspects of the "American way of life" which are NOT admirable nor desirable and I feel that advertising methods, manners of speech and spelling etc., may well lay the

However, the basic concept originat
with your humble Technical Editor a
it is not incongruous that I should of
any defence which might be necessa

But one point I must stress, right
the outset. I am not interested in c
bating our correspondent's very strong
expressed "national" likes and dislik
Maybe he is "pulling our leg" to a c
tain extent but I've a very strong feeli
that his own have suffered similar, se
imposed treatment.

STRETCHING THINGS?

To start with the spelling of one simp
word and end with a quotation abo
human lives and a cartridge is stretchi
things just a trifle.

And to accept the same word
evidence that the staff of "Radio, TV a
Hobbies" are degenerating into "sni
salesmen" etc. may be a little unkin

His basic quarrel with us is our u
of the term "program Source," with p
ticular reference to the spelling of t
word PROGRAM. This is allegedly u
British, un-Australian and pro-Americ
— leading on to kinds of dreadful thin
as listed.

So accused, I naturally hastened

e fountainhead of all knowledge in ch matters in a newspaper office. I fer to the "Readers," who are charged ith maintaining the uniformity, style, rrectness and (in the case of certain isprints) decorum in what appears in e Company's many publications.

For 20 or more years, the spelling, rogram" has been regarded as standard all publications produced by our par- t company.

We are now additionally associated ith John Fairfax Ltd., a company of me small standing in the newspaper orld. A John Fairfax style book dated early as 1934 also shows, as standard, e spelling, "program."

Now all this mightn't cut much ice ith our correspondent, merely indicating at the lamentable influence has spread ider and deeper than even he had im- gined!

He must surely and forthwith add sev- al more publications to his black list.

But wait. The aforesaid readers in- rmed me that the spelling in question as not an Americanism but was, in fact, stified by no less than the Oxford dic- onary, which they regard as — and I ote—"the readers' Bible."

They informed me, further, that "pro- am" was the original English form for e word.

OW THE QUESTION

Then how come "programme?"

The suggestion is that this is a basic rench form which has since got itself lopted into English usage, possibly by ason of its more "sophisticated" or nate appearance.

It has become so firmly established at it appears as the preferred form in merous smaller dictionaries and is ccepted in many circles as the correct ay of spelling the word.

If this information is correct—and I'd ther somebody else do the research ecessary to prove or disprove it—we ave the following situation:

(1) The English have been guilty of ing the French and are continuing un- ittingly to do so;

(2) The Americans have reverted to e original English word form;

(3) We have done likewise;

(4) Our correspondent, all this time, as been barracking for the wrong side.

Incidentally, and by way of general terest, I have been assured that the resent trend toward simplification of ords, punctuation, abbreviations and hole forms of expression is not the mple result of American influence. It a natural and spontaneous world-wide onomy measure and is recognised as ch in business circles.

But I must confess that nothing as ademic as all this influenced my own rsonal and deliberate choice of the rd "program" for the panel of the ier.

It was the very simple fact that the ger form, "programme," would have npromised the appearance of the word up, "Playmaster PROGRAM URCE."

Perhaps, for R.D.'s benefit, we should e simply called it a TOONER!

By the way, R.D. You mention a seball bat."

What on earth is that?

rom a reader in Brisbane, we have etter which contains a particular point which may profitably be extract- ed for purposes of argument.

At his request, we are not publishing his initials.

His main question is one which is put to us quite frequently: Why don't we add voltage and possibly current read- ings to our circuits (in this case TV) to facilitate trouble chasing?

It should be such a simple matter, he says, to run over the set, after adjust- ment and completion, to note the rele-

BRISBANE READER WANTS TO KNOW

"Why does not 'Radio, TV and Hobbies' publish a voltage analysis of their TV sets? If you people would go to that extra bit of trouble to neatly indicate at each plate, screen and cathode the voltage that can be expected, how much more easy it would be for us who have access to good test equipment."

vant voltage and current figures and to give them to our draughtsman for addi- tion to the circuit.

In many cases we could possibly do so—if it were as simple as that—even though lack of time might beat us in other cases.

But it isn't anything like as simple as that.

Voltage and current readings on a circuit must be truly typical and meas- ured under certain stated conditions if they are to serve the intended purpose. If the above is not true, then the figures are worse than useless. They can be actively misleading and imply a fault where, in fact, no fault exists.

I wonder whether you have ever thought about this problem?

Difficulty Number 1 is that of obtain- ing typical figures in the first place.

Practically every component which goes into a receiver or amplifier car- ries some tolerance on its value or values. Most likely it is 10 p.c., but it could be greater.

As a result, the DC operating levels of each individual stage are dependent on the particular valve, its plate, screen and bias resistors, its supply voltage and, perhaps, its input drive and its effective output load. Each one of these is sub- ject to variation and the readings on a stage are the result of a random combin- ation of these variables.

This almost sounds like a reason why a stage should hardly work at all, in some cases. In practice, however, one of the aims of a designer is to make the operation of the product as uncritical as possible, in regard to tolerances, as judg- ed by the customer's normal appraisal of the sound or picture.

In the aggregate, component variations tend to balance out, a little bit of extra current or gain at one point or in one stage tending to be balanced by a reverse condition somewhere else.

But a close examination of individual stages or circuit points with instruments will reveal these variations and are the very reason why spot readings on an in- dividual chassis cannot be taken as truly typical.

It may well be that the exact gain or current in one stage is towards the bottom of the tolerance limit, though unwittingly balanced out in the overall result by a counter circumstance else- where.

Let's say that the voltage at the plate of an amplifier is measured, under par- ticular conditions, as 90 volts. We might then assume that anything within about 10 per cent of this figure would be satis- factory, giving a tolerance range 80 to 100 volts.

But there is no guarantee that the true, typical voltage for the stage may not be 100, with a tolerance range of from 90 to 110.

It would thus transpire that the figure of 90, derived from an individual speci- men chassis, would be low but in toler- ance. However, a figure of 80, wrongly assumed on this basis as a tolerance limit, would actually be low and perhaps indicative of trouble.

Conversely, a figure of 110 volts might be accepted as an abnormality, whereas it is really in order.

Thus, by not correctly establishing the voltage in the first place, some abnormal figures are made to look right and normal figures to look wrong.

There are two obvious ways of beat- ing this difficulty. The first is to test every individual component, from the power transformer and deflection yoke, right through to the smallest resistor and capacitor, to ensure that it is exactly as it is supposed to be and right in the middle of the intended tolerance range for major and sometimes minor charac- teristics.

I don't need to tell you how such an approach would slow up the original project.

What an understatement is the expres- sion "it would be a very simple matter . . . etc."

The second method is the one norm- ally used in large factories. After the original design has been finalised and freed of as many "bugs" as possible, the assembly line does a pilot run of the item.

This allows the production people to assess time cycles and possibly iron out any unforeseen difficulties in assembling, wiring or testing.

But it also gives the development en- gineers the chance of observing varia- tions between production samples and of assessing an average and limits for any particular quantity that needs to be recorded for service purposes. The more sets available, the more accurately can this be done.

But where there isn't any production line . . . well . . . You see what I mean.

Nor is this the end of the story. From the user's point of view, he must be in- formed as to the voltage figure and how measured—on a VTVM or on an ordin- ary multimeter; if the latter, on what range.

There are complications of "with and without signal" and, in the case of angular waveforms, what influence these may have on a "DC" reading or con- versely what influence on the waveforms and behaviour the presence of a meter prod may have.

By the time all these things are con- sidered and allowed for, there would be a danger of both engineer and draughts- man being driven to drink.

And we can't spare either!

(See also pages 75 and 77)

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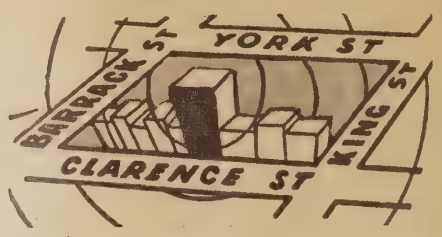

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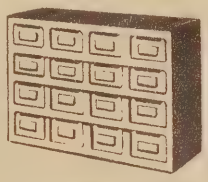

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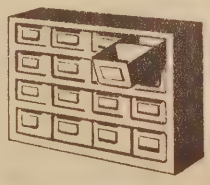

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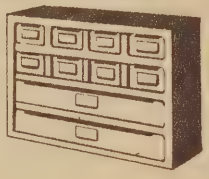

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ARGUMENT—LOGICAL AND ILLOGICAL MACHINES

In the November issue, we published an article by R. Hartkopf which presented a lot of interesting material behind a slightly humorous facade. Written in much the same style, the following is an excellent commentary on that original article.

By Vol. Molesworth, M.A., (VK2VO)

THE brief introductory article on "Switchcraft" which appeared in the November, 1959, issue of "Radio, Television and Hobbies," is at once both refreshing and depressing.

It is refreshing to see the marriage of logic and electronics officially noticed in a journal which has established itself over 20 years as a competent reporter in the field of radio-electronics. That the marriage was celebrated a long time ago only emphasises the need, now, for articles, experimental circuits, and arguments. Better late than never.

Perhaps it may be argued that the practical implementation of the theory of logic machines had to wait on the availability of suitable components (transistors, printed circuits, etc.); perhaps that spectacularly obvious applications (sputniks, moon rockets, etc.) had to hit the headlines before space could justifiably be devoted to logic machines in hobbies magazines.

HOPE FOR MORE

Whatever the reason, the appearance of this first article in "Radio, Television and Hobbies" breaks the ice, legitimises the subject and offers the hope of more articles, more circuits, and much discussion, in the future.

It is refreshing, also, to see the title under which this trail-blazer appeared. "Switchcraft" is apt, because it is the art of turning this way or that. It is an either-or, left-right, yes-no affair. The switch is either on or off. This is precisely the form of a logical decision.

The founder of systematic logic, Aristotle, made no bones about the two-valuedness of logic. It was impossible he argued, that a thing could be both so and not-so. It either was, or it wasn't. This gives us the question which Parmenides said can be asked of any alleged state of affairs: "Is it, or is it not?"

The simple toggle switch, which turns the current on or off, is the perfect physical illustration of this fundamental logical principle.

If we wish to assign the values of "true" and "false" to our switch positions, the only empirical criterion is the occurrence or non-occurrence of the situations they represent.

A statement is true if what is stated occurs; the same statement is false if what is stated does not occur. And since there can be no alternative to being or non-being, the choices are mutually exclusive and, taken together, exhaust the possibilities.

Suppose the question is asked, "Is the current on?" If the switch is down (according to local wiring practice) the answer "yes" is assigned to the question; if the switch is up, the contradictory answer is automatically assigned.

If some wag asks what happens if the switch gets stuck in the middle, the logical position is that the switch positions are not strictly "up" and "down," but "make" and "break" (or better still, "make" and "not-make"); if the pole is making contact with the stud, the current is on and the answer is "yes"; if the pole is not making contact, the current is off and the answer is "no."

Multiplying the number of poles and studs does not alter the basic principle of operation; it merely means that a complex range of "yes-no" decisions are made simultaneously.

A LOGICAL DECISION

It would be quite wrong, however, to suggest that operating a switch is merely like making a logical decision. It IS a logical decision. It is not an analogue, but a working model.

It is refreshing, therefore, to find the first bite at the theory of logic machines published under the title of "Switchcraft." And if one is tempted to ask, why not call a spade a spade and publish the article under the title of "An Introduction to the Theory and Construction of Logic Machines," the answer is not hard to find.

In the modern world, the science of logic has undergone a serious decline. This is due partly to a quite widespread misunderstanding of the nature of logic; partly to a scientific reaction against philosophy (which fathered the science of logic); and partly to the fact that similarities between mathematics and logic have been wrongly taken to be identities.

But since this is a radio journal and not one of the trade-journals of philosophy, this point cannot be developed.

Turning now to the "depressing" feature of the otherwise excellent article, we come to the somewhat illogically presented problem of the weather forecast.

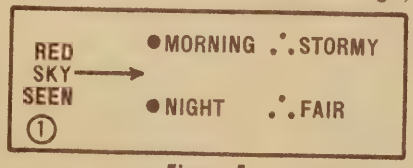

Figure 1

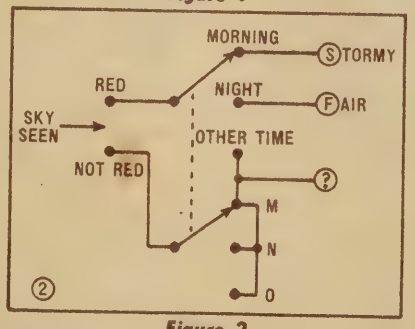

Figure 2

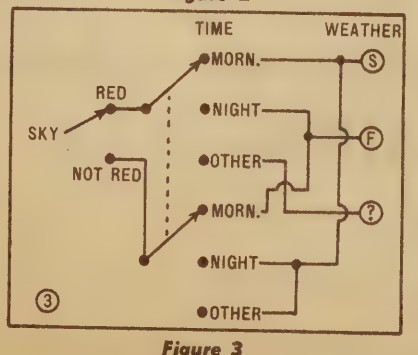

Figure 3

WEATHER FORECAST

The premises supplied are that a red sky in the morning indicates stormy weather, and that a red sky at night indicates fair weather.

From this a so-called logic machine has been designed (see circuit in November 1959 issue) which feeds in certain data, gives us certain choices, and provides three possible answers—either that the weather will be stormy, that it will be fair, or that it is unpredictable.

While this circuit certainly illustrates the general principles of making logical decisions, and has no doubt been simplified for the purposes at hand, it nevertheless contains serious inconsistencies which may give readers a quite false idea of how logic operates, and hence how a logic machine should operate.

First of all, the machine is supposed to operate ONLY on the data which is fed into it. It is not supposed to supply additional data itself. No doubt, a super-dooper model would sound alarm bells and flash up a sign, "Insufficient Data," but in the T-model Ford stage of our introductory article we cannot assume such finesse.

The verse supplies us with two time variables, "morning" and "night," apparently mutually exclusive. It is either morning, or it is night. It cannot be morning and night at the same time.

There is, however, no evidence that it must be either morning or night. It could conceivably be neither morning nor night. It could be midday.

In the switching model, however, this possibility is ignored. We are provided with a simple yes-no choice. When it isn't morning, it is night. When night ends, we have morning. There are no lunch-breaks, no pre-dinner cocktails, no 5 p.m. rush in our logic model.

WHY THE CHOICE?

If this is so, then why is the completely unwarranted choice of "red" and "not-red" introduced? It certainly doesn't come from the verse. All the verse tells us (and should tell the machine) is that the farmer sees red skies. When he sees them in the morning, he knows the weather will be stormy. When he sees them in the night (non-morning) he knows it will be fair.

If, in building our machine, we allow for the possibility that the sky can be other than red (sometimes foreign to the data supplied), then equally we must allow for the possibility that the time at which the sky is inspected is other than morning or night (something foreign to the data supplied).

The alternatives of "stormy" and "fair" are provided by the verse, and

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have been taken at their face value in constructing the model. But if we are going to play around with the possibility that the sky can be other than red, then in consistency we must allow for the possibility that the weather can be other than stormy or fair—it could be non-stormy non-fair (sort of middling).

Since "red" is constant in the verse, and only "morning" and "night" are variable, the weather-prediction machine can actually be constructed (on the verse) as a simple switch (Figure 1).

BE CONSISTENT!

Since, however, the possibility of the sky being other than red has been introduced, let us in consistency introduce the possibility that the sky (either red or not red) is sighted at some time other than morning or night. The circuit would look something like that shown in Figure 2.

Since all that we have done is wasted a wafer, some busbar and some solder, the constructed model brings out clearly the point that bringing in these possibilities has not helped us predict the weather any more accurately.

A logical inspection of the data supplied soon shows why.

We are told that whenever there is a red sky in the morning, the following weather will be stormy (and that a red sky at night means fair weather ahead), but we are not told these are the ONLY occasions on which such predictions can safely be made.

It may well be that when there is a non-red sky at morning, the weather will be fair, and when there is a non-red sky at night the weather will be stormy. It may also be the case that when the sky is not red at midday the weather is stormy.

The switch now gets a little more complicated. (See figure 3.)

SKY IS GREEN?

No doubt we could look for still other possibilities (what if it is New Year's Eve and the sky is green?) and build more and more either-or switches into our machine, but there would never be any point at which we could safely stop.

We would be like the Indian philosopher who stood the world on the back of an elephant, the elephant on the back of a tortoise and the tortoise on an "unknown somewhat"; the point being that once having started this vicious infinite regress, the Indian philosopher felt compelled to complete it, but knew he could not. On what did the "unknown somewhat" stand?

The lesson in all this is that our study of logic machines will not progress very far (or rather, it will go very far but not develop very sensibly) unless the human beings who design and operate the logic machines think and act logically themselves.

It is NOT logical to build in possibilities for one piece of information (not stated in the data supplied) and NOT provide similar possibilities for each other piece of information supplied.

If the data is at fault (if it leaves open possibilities which give unsatisfactory answers), then the data needs to be revised or supplemented or both: we must not build into our machine the shoddy thinking of our client.

This well may be the explanation for the vast monsters rejoicing in the names of "electronic brains," which are accumulating transistor banks in research laboratories in various parts of the world.

When one reads of logic machines employing thousands upon thousands of valves, one may feel happy for the young engineers who are being provided with interesting hook-ups for their Ph.D.s and for the component manufacturers who can add a few more noughts to their balance-sheets, but one must surely wonder whether the proliferation of valves and circuits results from some fundamental wrong-thinking about what logic is and how it operates.

It would not be difficult to design an electronic brain operating on Aristotelian logic. It would require no more than a dozen or so tubes (fewer if we use multiple-element types) and could be wired up in a few evenings.

It would, however, deal only with facts, their combinations and their logical implications. It would not deal with the hidden assumptions, the Freudian wishes, the unworldly imaginings, the subjective attitudes, or the plain original mistakes of its operator.

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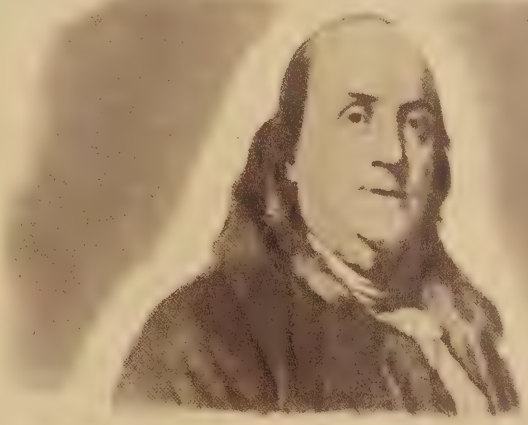

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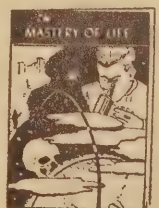

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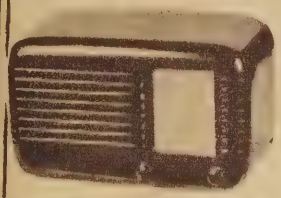

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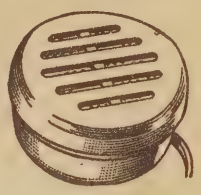

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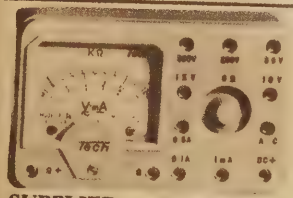

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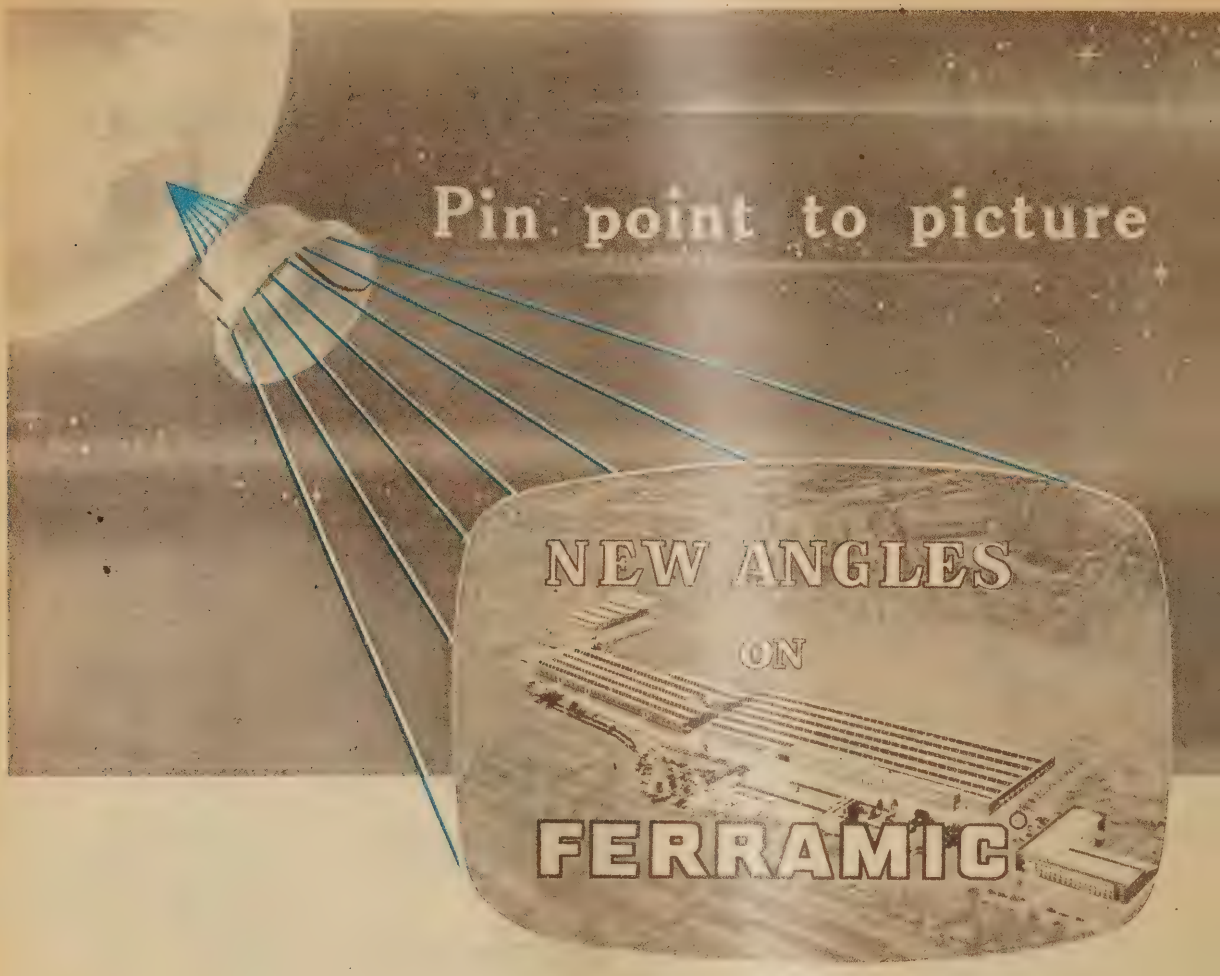

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by John Moyle

T'S only a matter of time before they will come to you and it's understandble why so comparatively few of them ndertake the long journey to Australia.

This was emphasised for me during second visit I made to Paris a few veeks ago, when most of the conference heads" were attending a special trip to Zurich arranged by the citizens of that ity in their honour.

Not being among their august company, I took the opportunity of a long veekend of inactivity to visit the opera ouses and see a little more of the huge etropolis which is probably the most eautiful in this part of the world. At ast through my eyes.

GOOD SELECTION

Both the Opera proper and the Opera omique were well launched into their easons although, of course, there are numerable smaller places where firstass music and ballet are going on all e time.

If one were to spend a week, there ould be a choice of several worthwhile ncerts available every evening, in addin to opera and ballet.

Some of the names familiar to record vers which I noticed on the cylindrical vices they use to display such adverements and appearing for the week cluding and following my visit were: etrich Fischer-Dieskau, who has a putation virtually second to none in his ld, with Karl Engel (pianist); Mischa man, who must be the last of his era ll on the concert platform; Andre Cluys conducting the Societe des Concerts chestra; Byron Janis, a brilliant pianist ll represented on disc; Julius Katchen ying Beethoven, Mozart and Brahms the same program; and many others have not heard of.

And in the main opera houses one uld, if owning a dual personality, have n Le Chevalier a la Rose, Don Juan ozart), Faust, Rigoletto, La Fille de dame Angot, Mireille, La Tosca and Pecheurs des Perles, together with eral ballets on odd nights.

NCIENT HISTORY

Half a dozen other evenings could 've been spent at the Comedie-Franse and the Theatre de France.

But being only a single entity, I settled Tosca at the Opera Comique, my first t there, and Faust at the Opera House.

The Opera Comique, whose early and quered history goes back to 1714, is uilding which, after a series of fires ch seem to have consumed most of theatres of the day in all countries, built in 1898. Since then it has duced 401 works, from 206 comers, created 222 of them and in addi has staged 111 ballets.

is very much smaller than the Opera se. In fact, it is estimated that its le bulk could be accommodated in the space behind the stage of the Opera, which must be as large as, if not larger than, any other in the world.

It is also less formal and, fortunately, cheaper, for good seats in this part of the world are not cheap.

But it manages to put on an excellent performance, although not as lavish as those I have seen elsewhere.

The Opera House itself is proud of its lavish settings, and its mechanical arrangements have been entirely rebuilt in the past few years. As a result, Faust left little one could desire in the way of presentation.

ENTHUSIASTIC AUDIENCE

And its huge audience, always loyal and enthusiastic, makes a visit an event, at any time.

To be quite frank, I did not find the standard of the singing was as good as that I heard at Vienna, where they are making a great effort to revive the traditions of the past.

But this was more than made up for by the staging, and the gorgeous and lavish ballet scenes which the Opera is so well equipped to handle.

In this I think that only la Scala can compare and, in many ways, la Scala is peerless.

It emphasises the enormous if not insuperable tasks we have at home to present operas as they need to be presented if a continuous and lasting audience is to be maintained.

For the Opera is not only a place for performances—it is a school for the performers, particularly the dancers, to whom it is a centre and a way of life.

MAINTAIN QUALITY

Only a country which is prepared to finance as well as to encourage can hope to maintain the kind of quality a regular following can expect.

★ ★ ★

A musician I have always wanted to hear in person came to Geneva a couple of weeks ago and with his string orchestra gave a concert in the Victoria Hall.

He was Janigro, a cellist who greatly impressed me some years ago in a superb recording of the Dvorak cello concerto, released by Westminster.

I have often wondered what became of him, for he hasn't been heard of on records, at least in Australia, for some time.

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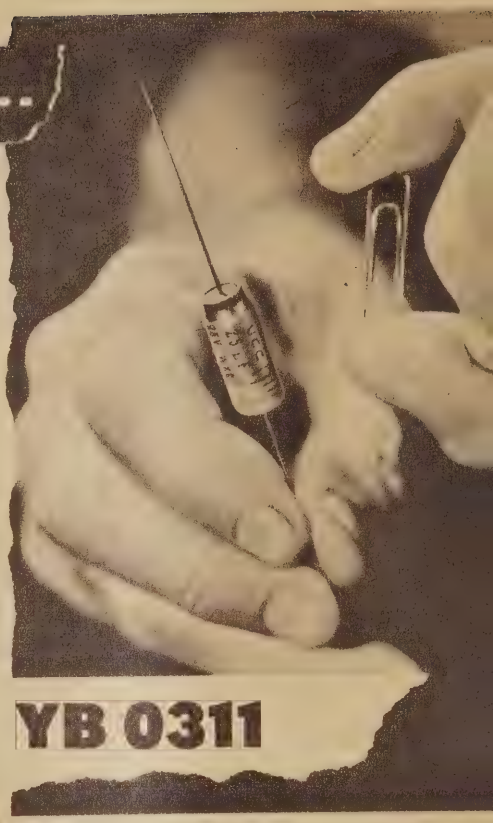

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he has gathered together a string orchestra of 12 players, which at the moment is apparently on a European concert tour.

Janigro himself is the star in at least one item at these concerts; this time it was a work by Couperin.

He is a youngish, vital and dark-haired Italian who does everything, including conducting, with the highest musicianship and technique.

His orchestra is composed of people many of whom are of concert performer standard and their playing was a delight to hear.

The Victoria Hall was an ideal setting to show off their flexibility, precision and perfection of style.

A HIGHLIGHT OF VISIT

Janigro's performance exhibited every quality his records would lead one to expect and his concert to me was a highlight of this visit to Europe.

★ ★ ★

In London, Klemperer is giving a whole series of Beethoven concerts in the Festival Hall, with the Philharmonia orchestra, and you will well remember how famous his recordings of the complete symphonies have become.

From reviews of the first of them which have appeared in the London Press he is doing them as well as ever.

Beecham is also being well received at the Festival Hall at the moment and his recent reported utterances indicate that he is in form.

Landing recently at London Airport from Europe, he was asked how he was. "Rotten as usual," he replied. When reminded that there were some beauty contestants on the same plane, he said, "Oh, and what are they contesting?" When the matter was—quite unnecessarily, I'm sure—explained to him, he snorted, "A beauty contest without me? Ridiculous!"

This kind of repartee puts English people into convulsions and no doubt one has to hear the conversation itself to fully appreciate the humour of England's doyen of conductors, perpetuating the old traditions.

But about his ability to make an orchestra give of its best there seems to be little ground for doubt or disappointment.

In the meantime comment is free on the release of more cheaper records in England.

Rather than attempt a hurried assessment myself, the following notes from the London "Telegraph" can tell the story. I quote:

SALES DOWN

"At about £2 each for a 12in, records are a costly item. We have no cut-price shops, such as flourish in America, and not many second-hand shops; and the amount handed over the counter week by week for new L.P.s has continued to astonish the toughest dealers.

"Nevertheless, last January's record sales were down by a fifth compared with the previous year's, and behind the scenes there was clearly a good deal of brow-furrowing. Efforts were renewed to get the 60 per cent purchase tax cut, but with only limited success. Sales have now steadied again, but meanwhile a new approach to record selling has blossomed.

"Some companies resist the term "cut-price," feeling it more suitable for old lines of soup. Nevertheless, it is at a sharply cut price that four of the big firms are now offering some of their wares.

"It started in June, 1958, with Decca's ingeniously named Ace of Club's series, trumping the hand of the record clubs, for which the companies have shown a hysterical loathing. Decca revived some deletions and made a few new recordings, aiming their shot at the numbers of young people wanting to found a basic library. The price was a mere guinea, the response terrific.

"Pye, taking a closer analytical look at the market, discovered that only 12 per cent were regular collectors, the rest just buying a record occasionally. In August they aimed at this remaining 88 per cent a Golden Guinea series (stereo at 27/6) of new issues, and in their first batch produced a record that made No. 5 in the L.P. popularity lists.

"Two newcomers are Philips and H.M.V., who both charge 22/6. H.M.V.'s Concert Classics series consists of new issues only; Philips have some old, some new. Another company, Vox, is relying on squeezing more and more on to one normal-priced record, having just packed the whole Missa Solemnis (Klemperer, a reissue) on to a single 12in, 72 minutes 30 seconds of music; it also does boxed sets of three discs for the price of two. Telefunken, under the Decca umbrella, have just announced a series at 26/2½.

WHY THIS WAIT?

"At this point one might reasonably start asking why we've had to wait so long to get cheaper records. The sudden eagerness of everyone to get into the act suggests that the January drop, added to dealers' anxieties about the record clubs, was the red light. H.M.V. and Decca say that they can do it because the cost is shared between artists taking a lower royalty and themselves accepting a lower profit. Decca and Philips, moreover, re-use some of their old stock, which has already earned its keep. Pye take over American recordings (some of them made in this country).

"In any case, the argument runs, the cheaper records entice the customers into the shops, which pacifies the dealers and may boost normal, full-price sales. It is an investment; one might wish it could have been made a bit sooner.

"Meanwhile, the record clubs continue to flourish. The enmity of some of the big companies has not upset them, despite the refusal of certain magazines to take their advertising or to review their records, nor do they expect to lose trade over the new cheap records.

"The Record Society (70, Brook Street, W.1) claim a loyal membership, despite the comparatively high price of their records (12in, 33/6; 10in, 23/11). They appeal to a connoisseur public (they are connected with the Folio Society), and include the best-designed sleeves on the market and booklets of program notes and translations.

"There is no subscription, and they can buy, for about £120, a special stereo gramophone.

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"The World Record Club also claims a faithful, well-cared-for membership, and has provided it with some unique records (Nielsen's sixth symphony, from a Danish list, and now the first record by Colin Davis). Twenty-four records come out a year, costing on an average 21/6, and members (who pay no subscription) need take only one.

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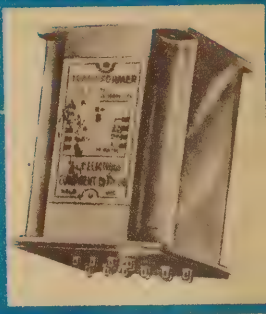

MEDIUM FIDELITY

See Valve Chart	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
A	928A	5	7,000, 5,000 S.E.	15, 8, 3.7, 2
B	932	7	10,000 P.P.	15, 12.5, 8, 3.7, 2
C	929	10	4,000, 2,500 S.E.	15, 12.5, 8, 3.7, 2
C	930	10	4,000, 2,500 S.E.	500, 250, 125
—	809	15	500 (line)	15, 12.5, 8, 3.7, 2
D	914	15	5,000, 3,000 P.P.	500, 250, 166, 125, 100
D	915	15	5,000, 3,000 P.P.	15, 12.5, 8, 3.7, 2
E	917	15	10,000, 8,000 P.P.	500, 250, 166, 125, 100
E	918	15	10,000, 8,000 P.P.	15, 12.5, 8, 3.7, 2
F	922	25	8 000 P.P.	500, 250, 166, 125, 100
F	891	35	6,600 P.P.	500, 250, 166, 125, 100 83
G	892	55	3,200 P.P.	500, 250 125, 83, 62, 50

HIGH FIDELITY

See Valve Chart	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
P	2558	3	10,000 S.E	15, 8, 3.7, 2
	933	3	5,000 S.E.	15, 8, 3.7, 2
H	870	6	10,000 P.P.	2 or 8
	2525-8	10	8,000 P P.	2 or 8
	2525-15	10	8,000 P P.	3.7 or 15
J	871	12	10,000 P.P.	2 or 8
J	872	12	10,000 P.P.	3.7 or 15
D	763	15	5,000, 3,000 P.P.	15, 12.5 8, 3.7, 2
E	896	15	10,000, 8,000 P.P.	15, 12.5 8, 3.7, 2
E	897	15	10,000, 8,000 P.P.	500, 250, 166, 125, 100
D	920	15	5,000, 3,000 P.P.	500, 250, 166, 125, 100

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L	916-8	12	8,500 P.P.	2 or 8
L	916-15	12	8,500 P.P.	3.7 or 15
M	921-8	20	6,600 P.P.	2 or 8
M	921-15	20	6,600 P.P.	3.7 or 15
N	931-8	20	4,500 P.P.	2 or 8
N	931-15	20	4,500 P.P.	3.7 or 15

HIGH FIDELITY—*Ultra Linear*

Screen Taps 19% of Plate Impedance — 43% Turns.

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Qt	4005	7	9,000 P.P. (U.L. Taps 20% Turns)	3.75, 7.5, 15
	2540-8	10	8,000 P.P.	2 or 8
	2540-15	10	8,000 P.P.	3.7 or 15
†	4000 8	10	8,000 P.P.	2 or 8
†	4000-15	10	8,000 P.P.	3.7 or 15
†	4001-8	20	6,600 P.P.	2 or 8
†	4001-15	20	6,600 P.P.	3.7 or 15

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F:	6L6G's, 807's, KT66's, in Class AB1.
G:	6L6G's, 807's, EL34's, EL37's, in Class AB2.
H:	6V6GT's, 6BW6's, 807's, as Triodes in Class A
J:	6L6G's, 807's, KT66's, etc., in Class A.
K:	6V6's, 6BW6's, KT61's, EL84's, etc.
L:	6V6's, 6BW6's, KT61's, etc.
M:	807's, KT66's, EL34's, etc.
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MULLARD 5/20	PT 1902	180	410-0-410	5V. 3a.	6.3V. c.t.: 4a., 6.3V. c.t.: 2.5a.	OT 4001 See above.
MULLARD 2 Stereo 2	PT 1884	80	250-0-250	6.3V. 1a. tap at 5V. 2a.	6.3V. 2a., 6.3V. c.t.: 2a.	OT 2558 See above
MULLARD 5 Stereo 7	PT 1896	150	250-0-250	6.3V. 1a. tap at 5V. 2a.	6.3V. c.t. 2a., 6.3V. c.t. 2a.	OT 4005 See above.

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RECORD REVIEWS :—

J. S. BACH—Toccata and Fugue in D minor, Prelude and Fugue in C major, Trio-sonata No. 1 in E flat major, Trio-sonata No. 6 in G major. Played by Helmut Walcha. Archive 198002 SAPM (Stereo).

Walcha is one of the leading Bach performers of the day and an extremely authoratitive one.

He isn't at all concerned with coloured performances, and if you are interested in hearing a D minor in the grandiose manner you won't get it here.

But you will hear one which is vigorous, clean cut and factual.

As with all four works, you will delight in the clear registration, no cover-ups, no stop-fumbling, well graduated dynamics, the products of a master organist.

He is obviously an uncompromising exponent of the music, and his handling of the intricate counterpoint is clean and firm, with all the meticulous earmarks of a devoted student.

It is a record for connoisseurs, and for them it has rich rewards.

He is at his best I thought in the slower and more reflective passages with which this music abounds, and for which the organ is so admirably voiced.

It is, incidently, the organ of St. Laurenskerk in Alkmaar, Holland. The well annotated folder contains a sheet giving full details of each work, and of the organ itself, a most valuable aid to one's understanding and enjoyment.

Only in Trio-sonata No. 6 did I detect anything which sounded like unsteadiness in the extremely difficult Vivace — elsewhere his work is a model of consistency.

The stereo has given a roundness to the organ tone which can only be appreciated when playing it for contrast in the mono position. Incidentally the notes seem to indicate it was recorded in 1956.

There are some sections which I found difficult to play without a faint trace of fuzz, and the surface noise is a little higher than I would have liked. There seems also a microscopic pitch change near the end of the first Trio-sonata.

But as one who finds no difficulty in listening to Bach for long periods, I welcome it as an important addition to a much neglected field.

★ ★ ★

BEETHOVEN—Symphony No. 4 in B Flat Major, Opus 60; Leonore Overture No. 1. Played by the B.B.C. Symphony Orchestra conducted by Arturo Toscanini (recorded in 1939). HMV OALP 1598.

It is a tribute to Toscanini that a recording made by him in 1939, more than 20 years ago, can still be issued with the knowledge that people will buy it to hear how it was done in those days.

The B.B.C. orchestra then was probably as good as it has ever been. Toscanini was a man who could always make a good orchestra sound even better, for even the best considered it a privilege to play under his baton.

As usual, this is a taut performance, uncompromising in its devotion to the score, unswerving in its line, determined to let the music speak for itself.

The second movement is an excellent example of this. I don't think any conductor has extracted as much of the true feeling and angry pathos of what I always think the most intensely personal and heart-felt movement of all the symphonies.

Beethoven was never a man to show his more sensitive feelings lightly—one feels as though he is forced to display them almost against his will, certainly in the period of this symphony.

Toscanini is one of the few conductors great enough to appreciate this quality, and the serenity he achieves at the conclusion of this movement, followed by the final almost defiant burst, are among the best moments in the symphony.

Because it was made so long ago, and dubbed from the 78 discs, one can find many points of criticism if one feels like it.

The sound is not free from flaws, and quite often, particularly at the end of the very first 4½-minute period, we are conscious of the break between one disc and the next.

But such things are only to be expected, and don't surprise us.

It's a record which still retains its essential musical and historical value.

The Leonore Overture is if anything better than the symphony, and it is the only recording Toscanini made of it.

This record has been on issue since last April, but unaccountably I have missed it out in my reviews.

★ ★ ★

GERSHWIN — Concerto in F, Rhapsody in Blue for Piano and Orchestra. Played by Eugene Liszt and the Eastman Rochester Orchestra, conducted by Howard Hanson. Mercury SR-90002 (Stereo).

Eugene Liszt is a facile and understanding pianist for Gershwin.

His fingers skip around the sidewalks and gardens of New York with complete command, and even the most demanding passages find his digits quite at ease and with apparently time on their hands.

The recording is rather remote and I think it loses some impact thereby, but only by comparison with the increasingly vivid standard reached by some of the latest efforts.

I was struck with the clear and authentic changes of mood by the pianist as he moved from one impression to another in the concerto, which is played probably as well as it has been so far.

The music suits the Eastman orchestra, which has always been robust and can make some brilliant and completely American sounds.

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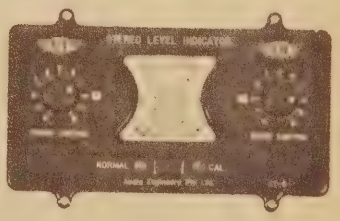

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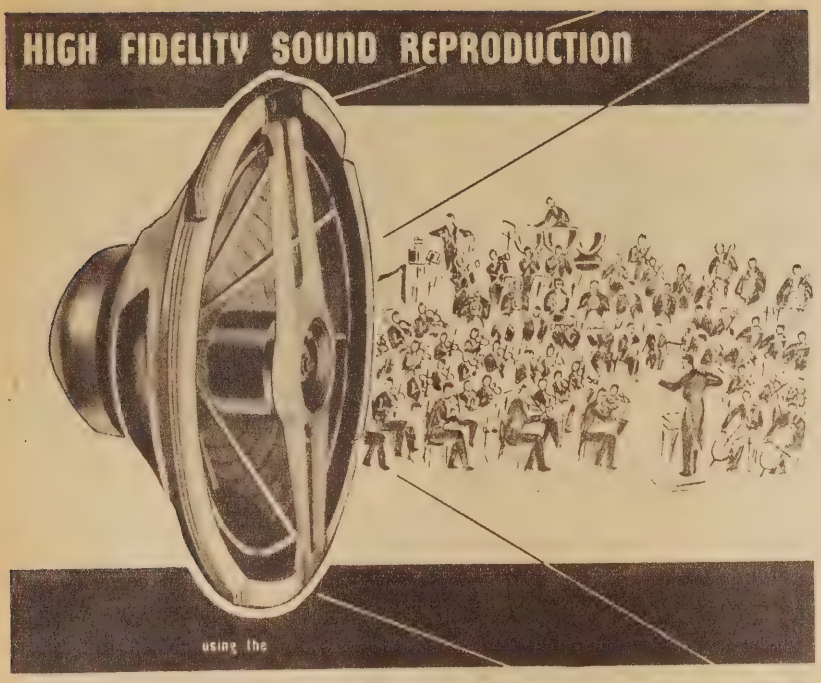

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6 1 2"	21069-6PU/3	3	125 · 15	6500	4.5
6 1 2"	21166-6PU-15	15	125 · 15	6500	6.0
7" x 5"	20944-75PU/3	3	115 · 11	5000	5.0
7" x 5"	21167-75PU-15	15	115 · 11	5000	8.0
7"	21253-7PT/3	3	120 · 10	5000	5.0
9" x 6"	21502-96PU-3	3	115 · 11	7500	5.0
9" x 6"	21168-96PU-15	15	115 · 11	7500	10
9" x 6"	20946-96PS/3	3	115 · 11	6500	6
9" x 6"	21169-96PS-15	15	115 11	6500	10
12"	21580-12PU-3	3	70 · 7	6500	6
12	21570-12PS-6	6.5	77 · 12	6500	10
12"	21567-12PQ-15	15	67 · 12	6500	15

WIDE RANGE COMBINATIONS

6 1 2"	20766-6PU-25	25		3000 10000	2
9 x 6"	20910-96PS-15	15	70 · 10	4000	12
12"	21011-12PS-15	15	55 · 5	3500	12
12"	20928-12PQ-15	15	55 5	3500	15

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They do it here completely in charac ter.

The Rhapsody in Blue is also good but it has a subtlety which isn't alway to be found.

The stereo does a good deal for both in an unobtrusive way, and enhances th air of reverberation which goes with th microphone placement.

A reliable and thoroughly competen performance.

★ ★ ★

A FAREWELL TO STEAM — Actuality recording of the last run from Los Angeles to Barstow. Hifirecord SR901.

I think there must have been a glin in somebody's eye when I was sent thi Railroad record, for it is one aimed dedicated types who find a fascinatio in the "sounds of a vanishing era."

The Atchison, Topeka and Santa F railway is part of American history, an its abandonment of steam in favour the diesel-electric was a sad day for th faithful to whom railway engines are way of life.

So that when the last steam train wa scheduled to run, members of the Rai way Club of Southern California aske to operate it in a farewell to steam.

A complete eight-car train was booke out by 400 enthusiasts who made it a event.

Along with the train went a recordi crew whose aim was to catch the sou of the big locomotive as it backed in Los Angeles station to pick up t coaches, as it pulled up steep grad puffed its way through the cities, a thundered along the track at speeds to 85 m.p.h.

Several different types of locomoti were used for the trip, and they a all faithfully set down on the jac notes so that you can pick one fr the other.

Thus instead of the close-miking an engine shunting backwards and f wards through the yards, we have authentic sounds of the train in act as heard apparently from a fixed po on the engine.

The collection of takes is rather connected, but this is no symphony steam. It is a record with a purp and I for one can vouch that it been well made.

The stereo is therefore used to create the atmosphere and not to ob left to right effects with which we familiar as a train rushes through station.

This may therefore be a record the few, but those who make up few will love every minute.

★ ★ ★

STRAUSS WALTZES — Blu Danube, Accelerations, Empero Roses from the South, Pizzica Polka. Played by the Vienna Sym phony Orchestra conducted by Jos Krips. Decca LXTA 5431.

The part played by Josef Krip reviving musical Vienna after the is well known, and he is therefo most appropriate conductor to lead famous orchestra in the traditional m of this traditional city.

And he does so with the highes gree of success. In every way this record of high quality.

Strauss at his best has been worthily praised as a magnificent composer, and these performances will not only serve to eliminate many back recordings from your mind but replace them with music of authentic atmosphere.

Josef Krips has treated them almost lovingly, intent on displaying all their melody, richness and subtlety.

Having never been to Vienna and sampled the air of the genuine Viennese style I cannot claim to be an expert, but I am quite happy to accept what this company has to offer as being what I imagine to be the real thing.

The orchestra rises to its challenge with superb playing and equally superb recording.

It produces some astonishing and beautifully graded dynamics so that every phrase and well-known tune is filled with interest and life.

Wisely the recording engineers have allowed just enough reverberation to build a breadth and airiness in the sound so that the orchestra's power is evident all the time, and even in its most delicately controlled moments its precision, attack and sense of rhythm are consistent and unfaltering.

It is so good that one cannot single out any section as better than another, which is the way it should be. This is the result of perfect balance so that everything from bass to cymbals is clear and convincing.

Even the surface is faultless.

If you don't admire this record as much as I do then you haven't got an ear for Strauss and that's final!

ROSSINI — Highlights from the "Barber of Seville" with Alvinio Misciano, Ettore Bastianini, Giulietta Simionato, Cesare Siepi, Fernando Corena, and the Chorus and Orchestra of the Maggio Musicale Fiorentino conducted by Alberto Erede. Decca LXT 5480.

The music of the Barber is always good—a musical phenomena in its way and quite the best thing Rossini ever wrote.

I don't class these performances in the very top bracket although there is some good singing.

Most impressive I thought was Cesare Siepi in his La Calunnia. His voice has more consistency than most of the others, but none of the singers is outstanding in their characterisation.

They sing their parts but do not convince me that they are living them, too.

Misciano has a light voice, reasonably flexible, but again in common with his colleagues not quite up to the more florid passages with either certainty or ease.

Simionato has good notes and she provides some of the best spots in the recording.

One excellent feature of the disc is the silent surface. It is of inestimable value in allowing us to concentrate on the music and in this respect it is as good as Decca have ever done.

Orchestrally it is adequate although there isn't as much presence as we generally hear on this label. From the fairly obvious cut in the tape at the end of one aria, these could well have been excerpts from a full-length recording.

THE BBC UNIQUE SOUND ARCHIVES

The B.B.C., through careful selection of historic items from its own recordings, has for the past twenty-five years been Britain's principal collector and preserver of recorded sound.

SOMETHING of the history and scope of the B.B.C.s Sound Archives was reflected at the Radio Show in London, where each year the B.B.C. illustrates various aspects of its work.

A cycloramic display showed recording equipment through the years, and through a loudspeaker examples of historic recordings in the Archives were reproduced, while a light indicated the type of apparatus used to make each one, together with appropriate photographs of the period.

The recordings ranged in time from Alfred Lord Tennyson's own reading of The Charge of the Light Brigade, to Sir Vivian Fuchs' dramatic final broadcast as he began his Antarctic journey, and Professor Lovell's experiment of bouncing his voice back off the moon.

This unique library was begun with modest resources in 1934.

As opposed to the B.B.C. Gramophone Library, which collects only commercial recordings, and the Library of Current Recordings, which handles the B.B.C.s own latest recordings of all kinds and, after they have been used, destroys those not required again, the Archives' staff assess every likely non-commercial disc or tape, with a view to preserving anything of value historically or for future broadcast use.

Its experienced assessors spend many hours each week listening to both music and the spoken word.

Material for preservation is copied on to discs from which matrices are made. At least six pressings are made from each matrix. One, unlikely ever to be used, except in the event of a series of unforeseen mishaps, goes into storage outside London. Another is kept available for use in lesser emergency in a storing place in London. The remaining copies join the 250,000-odd pressings already on the shelves.

The historical Sound Archives (apart from about 80,000 sound effects pressings) consist of some 26,000 items, and these are growing at the rate of about 1,000 items a year.

Items range from two-minute interviews to programs of over two hours. Most come from program material, some from private sources, while the rest are specifically collected by the Department's own recording and production unit which also frequently presents programs based on Archives material.

Emperors, poets, comedians, sportsmen, actors are among the Archives' resources. So are ordinary men and women who, with a first-hand recollection of bygone days have earned the immortality of a permanent recording.

B.B.C. radio and television producers draw constantly upon this unique source for programs broadcast in the domestic and overseas services.

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Mounting plate **15-6**

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AMATEUR RADIO PREFIX LIST

Set out below are the prefixes used with amateur station calls to indicate the country of origin. Each location or location group listed is recognised as a separate "country" by the American Radio Relay League. On the following page, the alternative listing puts the "countries" in alphabetical order.

CALL	LOCATION
AC3	Sikkim
AC4	Tibet
AC5	Bhutan
AP2	Pakistan
BV (C3)	Formosa
C (unofficial)	China
C9	Manchuria
CE	Chile
CE	Juan Fernandez
CE0	Easter Island
CM, CO	Cuba
CN2	Tangier
CN8	Morocco
CP	Bolivia
CR4	Cape Verde Islands
CR5	Portuguese Guinea
CR5	Principe, Sao Thome
CR6	Angola
CR7	Mozambique
CR8	Goa
CR9	Macao
CR10	Portuguese Timor
CT1	Portugal
CT2	Azores
CT3	Madeira Islands
CX	Uruguay
DJ, DL, DM	Germany
DU	Philippines
EA	Spain
EA6	Balearic Islands
EA8	Canary Islands
EA9	Ifni
EA9	Rio de Oro
EA9	Spanish Morocco
EA0	Spanish Guinea
EI	Republic of Ireland
EL	Liberia
EQ	Iran
ET2	Eritrea
ET3	Ethiopia
F	France
FA	Algeria
FB8	Amsterdam & St. Paul Islands
FB8	Comoro Islands
FB8	Kerguelen Islands
FB8	Madagascar
FB8	Tromelin Island
FC (unofficial)	Corsica
FD	Togo
FE8	French Cameroons
FF8	French West Africa
FG7	Guadeloupe
FI8	French Indo-China
FK8	New Caledonia
FL8	French Somaliland
FM7	Martinique
FN2	French India
FO8	Clipperton Island
FO8	French Oceania
FP8	St. Pierre & Miquelon Islands
FQ8	French Equatorial Africa
FR7	Reunion Island
FS7	Saint Martin
FU8, YJ1	New Hebrides
FW8	Wallis & Futuna Islands
G	England
GC	Channel Islands
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA	Hungary
HB	Switzerland
HC	Ecuador
HC8	Galapagos Islands
HE	Liechtenstein
HH	Haiti
HI	Dominican Republic
HK	Columbia
HK0	Archipelago of San Andres & Providencia
HL	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ	Saudi Arabia
I1, IT1, IP1	Italy
I1	Trieste
I5	Italian Somaliland
IS1	Sardinia
JA, KA	Japan
JT1	Mongolia
JY	Jordan
JZ0	Netherlands New Guinea
K, W	United States of America
KA0, KG6I	Bonin & Volcano Islands
KB6	Baker, Howland & American Phoenix Islands
KC4	Navassa Island
KC6	Eastern Caroline Islands
KC6	Western Caroline Islands
KG4	Guantanamo Bay
KG6	Mariana Islands
KH6	Hawaiian Islands
KJ6	Johnston Island
KL7	Alaska
KM6	Midway Islands
KP4	Puerto Rico
KP6	Palmyra Group, Jarvis Island
KR6	Ryuku Islands
KS4	Swan Islands
KS4	Rancador Cay & Serrana Bank
KS6	American Samoa
KV4	Virgin Islands
KW6	Wake Island
KX6	Marshall Islands
KZ5	Canal Zone
LA	Jan Mayen
LA	Norway
LA	Svalbard
LU	Argentina
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
MP4	Bahrein
MP4	Qatar
MP4	Trucial Oman
OA	Peru
OD5	Lebanon
OE	Austria
OH	Finland
OH0	Aland Islands
OK	Czechoslovakia
ON4	Belgium
OQ5, OQ0	Belgian Congo
OX, KG1	Greenland
OY	Faeroes
OZ	Denmark
PA0, PI1	Netherlands
PJ	Netherlands West Indies
PJ2M	Sint Maarten
PK1, PK2, PK3	Java
PK4	Sumatra
PK5	Netherlands Borneo
PK6	Celebes & Molucca Islands
PX	Andorra
PY	Brazil
PY0	Fernando de Noronha
PY0	Trindade & Vaz Island
PZ1	Netherlands Guiana
SL, SM	Sweden
SP	Poland
ST2	Sudan
SU	Egypt
SV	Crete
SV	Dodecanese
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TI9	Cocos Island
UA1, 2, 3, 4, 6,	European Russian Socialist Federated Soviet Republic
UA1	Franz Josef Land
UA9, UA0	Asiatic Russian S.F.S.R.
UA0	Wrangel Island
UB5	White Russian S.S.R.
UD6	Azerbaijan
UF6	Georgia
UG6	Armenia
UH8	Turkoman
UI8	Uzbek
UJ8	Tadzhik
UL7	Kazakh
UM8	Kirghiz
UN1	Karelo-Finnish Republic
UO5	Moldavia
UP2	Lithuania
UQ2	Latvia
UR2	Estonia
VE, VO	Canada
VK	Australia
VK	Tasmania
VK	Lord Howe Island
VK9	Cocos Island
VK9	Nauru Island
VK9	Norfolk Island
VK9	Papua Territory
VK9	Territory of New Guinea
VK0	Heard Island
VK0	Macquarie Island
VP1	British Honduras
VP2	Anguilla
VP2	Antigua, Barbuda
VP2	British Virgin Islands
VP2	Dominica
VP2	Grenada & Dependencies
VP2	Montserrat
VP2	St. Kitts, Nevis
VP2	St. Lucia
VP2	St. Vincent & Dependencies
VP3	British Guiana
VP4	Trinidad & Tobago
VP5	Cayman Islands
VP5	Jamaica
VP5	Turks & Caicos Islands
VP6	Barbados
VP7	Bahama Islands
VP8	Falkland Islands
VP8, LU-Z	South Georgia
VP8, LU-Z	South Orkney Islands
VP8, LU-Z	South Sandwich Islands
VP8, LU-Z	South Shetland Islands
VP9	Bermuda Islands
VQ1	Zanzibar
VQ2	Northern Rhodesia
VQ3	Tanganyika Territory
VQ4	Kenya
VQ5	Uganda
VQ6	British Somaliland
VQ8	Chagos Islands
VQ8	Maritius
VQ8	Rodriquez Island
VQ9	Seychelles
VR1	British Phoenix Islands
VR1	Gilbert, Ellice Islands & Ocean Island
VR2	Fiji Islands
VR3	Fanning & Christmas Islands
VR4	Solomon Islands
VR5	Tonga Islands
VR6	Pitcairn Island
VS1	Singapore
VS2	See 9M2
VS4	Sarawak
VS5	Brunei
VS6	Hong Kong
VS9	Aden & Socotra
VS9	Maldive Islands
VS9	Sultanate of Oman
VU2	India
VU4	Laccadive Islands
VU5	Andaman & Nicobar Islands
XE, XF	Mexico
XE4	Revilla Gigedo
XV5	Cambodia
XW8	Laos
XZ2	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
YN, YN0	Nicaragua
YO	Roumania
YS	Salvador
YU	Yugoslavia
YV	Venezuela
YV0	Aves Island
ZA	Albania
ZB1	Malta
ZB2	Gibraltar
ZC3	Christmas Island
ZC4	Cyprus
ZC5	British North Borneo
ZC6	Palestine
ZD1	Sierra Leone
ZD2	Nigeria
ZD3	Gambia
ZD4	Gold Coast, Togoland
ZD6	Nyasaland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha & Gough Island
ZE	Southern Rhodesia
ZK1	Cook & Manihiki Islands
ZK2	Niue
ZL	Chatham Islands
ZL	New Zealand
ZL1	Kermadec Islands
ZM6	British Samoa
ZM7	Tokelaus
ZP	Paraguay
ZS1, 2, 4, 5, 6	Union of South Africa
ZS2	Prince Edward & Marion Island
ZS3	Southwest Africa
ZS7	Swaziland
ZS8	Basutoland
ZS9	Bechuanaland
3A	Monaco
3V8	Turisia
3W8	Vietnam
4S7	Ceylon
4W1	Yemen
4X4	Israel
5A	Libya
9G1, ZD4	Ghana
9K2	Kuwait
9M2	Malaya
9N	Nepal
9S4	Saar

OFFICIAL A.R.R.L. COUNTRIES LIST
Courtesy of American Radio Relay League

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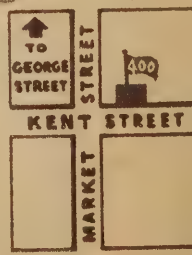


400 Kent Street, Sydne

Alphabetical List of Countries with Prefixes

The prefix list below has been re-arranged to place countries in alphabetical order, with their appropriate Amateur prefix listed alongside. See also list on preceding page.

CALL	LOCATION
VS9	Aden & Socotra
YA	Afghanistan
OH0	Aland Islands
KL7	Alaska
ZA	Albania
FA	Algeria
FB8	Amsterdam & St. Paul Islands
VU5	Andaman & Nicobar Islands
PX	Andorra
CR6	Angola
VP2	Anguilla
VP2	Antigua, Barbuda
LU	Argentina
UG6	Armenia
ZD8	Ascension Island
VK	Australia
OE	Austria
YV0	Aves Island
UD6	Azerbaijan
CT2	Azores
VP7	Bahama Islands
MP4	Bahrein
KB6	Baker, Howland & American Phoenix Islands
EA6	Balearic Islands
VP6	Barbados
ZS8	Basutoland
ZS9	Bechuanaland
ON4	Belgium
VP9	Bermuda Islands
AC5	Bhutan
CP	Bolivia
KA0, KG6I	Bonin & Volcano Islands
ZC5	Borneo, British North
PK5	Borneo, Netherlands
PY	Brazil
VS5	Brunei
LZ	Bulgaria
XZ2	Burma
FE8	Cameroons, French
XV5	Cambodia
VE, VO	Canada
KZ5	Canal Zone
EA8	Canary Islands
CR4	Cape Verde Islands
KC6	Caroline Islands, Eastern
KC6	Caroline Islands, Western
VP5	Cayman Islands
PK6	Celebes & Molucca Islands
4S7	Ceylon
VQ8	Chagos Islands
GC	Channel Islands
ZL	Chatham Islands
CE	Chile
C (unofficial)	China
ZC3	Christmas Island
FO8	Clipperton Island
TI9, VK9	Cocos Islands
HK	Colombia
FB8	Comoro Islands
OQ5, OQ0	Congo, Belgian
ZK1	Cook & Manihiki Islands
FC (unofficial)	Corsica
TI	Costa Rica
SV	Crete
CM, CO	Cuba
ZC4	Cyprus
OK	Czechoslovakia
OZ	Denmark
SV	Dodecanese
VP2	Dominica
HI	Dominican Republic
CE0	Easter Island
HC	Ecuador
SU	Egypt
G	England
FQ8	Equatorial Africa, French
ET2	Eritrea
UR2	Estonia
ET3	Ethiopia
OY	Faeroes
VP8	Falkland Islands
VR3	Fanning & Christmas Islands
PY0	Fernando de Noronha
VR2	Fiji Islands
OH	Finland
BV (C3)	Formosa
F	France
UA1	Franz Josef Land
HC8	Galapagos Islands
ZD3	Gambia
UF6	Georgia
VP8, LU-Z	Georgia, South
DJ, DL, DM	Germany
9GI, ZD4	Ghana
ZB2	Gibraltar
VR1	Gilbert, Ellice Islands & Ocean Island
CR8	Goa
ZD4	Gold Coast, Togoland
SV	Greece
OX, KG1	Greenland

CALL	LOCATION
VP2	Grenada & Dependencies
FG7	Guadeloupe
KG4	Guantanamo Bay
TG	Guatemala
VP3	Guiana, British
PZ1	Guiana, Netherlands
CR5	Guinea, Portuguese
EA0	Guinea, Spanish
HH	Haiti
KH6	Hawaiian Islands
VK0	Heard Islands
HR	Honduras
VP1	Honduras, British
VS6	Hong Kong
HA	Hungary
TF	Iceland
EA9	Ifni
VU2	India
FN2	India, French
FI8	Indo-China, French
EQ	Iran
GI	Ireland, Northern
EI	Ireland, Republic of
YI	Iraq
GD	Isle of Man
4X4	Israel
II, IT1, IP1	Italy
VP5	Jamaica
LA	Jan Mayen
JA, KA	Japan
PK1, PK2, PK3	Java
KJ6	Johnston Island
JY	Jordan
CE	Juan Fernandez
UN1	Karelo-Finnish Republic
UL7	Kazakh
VQ4	Kenya
FB8	Kerguelen Islands
ZL1	Kermadec Islands
UM8	Kirghiz
HL	Korea
9K2	Kuwait
VU4	Laccadive Islands
XW8	Laos
UQ2	Latvia
OD5	Lebanon
EL	Liberia
5A	Libya
HE	Liechtenstein
UP2	Lithuania
VK	Lord Howe Island
LX	Luxembourg
CR9	Macao
VK0	Macquarie Island
FB8	Madagascar
CT3	Madeira Islands
VS2, 9M2	Malaya
VS9	Maldive Islands
ZB1	Malta
C9	Manchuria
KG6	Mariana Islands
KX6	Marshall Islands
FM7	Martinique
VQ8	Mauritius
XE, XF	Mexico
KM6	Midway Islands
UO5	Moldavia
JT1	Mongolia
3A	Monaco
VP2	Montserrat
CN8	Morocco
EA9	Morocco, Spanish
CR7	Mozambique
VK9	Nauru Island
KC4	Navassa Island
9N	Nepal
PA0, PI1	Netherlands
FK8	New Caledonia
VK9	New Guinea, Territory of
JZ0	New Guinea, Netherlands
FU8, YJ1	New Hebrides
ZL	New Zealand
YN, YN0	Nicaragua
ZD2	Nigeria
ZK2	Niue
VK9	Norfolk Island
LA	Norway
ZD6	Nyasaland
FO8	Oceania, French
VS9	Oman, Sultanate of
VP8, LU-Z	Orkney Islands, South
AP2	Pakistan
ZC6	Palestine
KP6	Palmyra Group, Jarvis Island
HP	Panama
VK9	Papua Territory
ZP	Paraguay
OA	Peru
DU	Philippines
VR1	Phoenix Islands, British

CALL	LOCATION
VR6	Pitcairn Island
SP	Poland
CT1	Portugal
ZS2	Prince Edward & Marion Island
CR5	Principe, Sao Thome
KP4	Puerto Rico
MP4	Qatar
KS4	Rancador Cay & Serrana Bank
FR7	Reunion Island
XE4	Revilla Gigedo
VQ2	Rhodesia, Northern
ZE	Rhodesia, Southern
EA9	Rio de Oro
VQ8	Rodriguez Island
YO	Roumania
UA9, UA0	Russian S.F.S.R., Asiatic
UA1, 2, 3, 4, 6	Russian S.F.S.R., European
UB5	Russian S.S.R., White
KR6	Ryukyu Islands
9S4	Saar
FS7	Saint Martin
YS	Salvador
KS6	Samoa, American
ZM6	Samoa, British
HK0	San Andres, Archipelago of & Providencia
VP8, LU-Z	Sandwich Islands, South
M1	San Marino
VS4	Sarawak
IS1	Sardinia
HZ	Saudi Arabia
GM	Scotland
VQ9	Seychelles
VP8, LU-Z	Shetland Islands, South
ZD1	Sierra Leone
AC3	Sikkim
VS1	Singapore
PJ2M	Sint Maarten
VR4	Solomon Islands
VQ6	Somaliland, British
FL8	Somaliland, French
I5	Somaliland, Italian
ZS3	Southwest Africa
EA	Spain
ZD7	St. Helena
VP2	St. Kitts, Nevis
FP8	St. Pierre & Miquelon Islands
VP2	St. Vincent & Dependencies
ST2	Sudan
PK4	Sumatra
LA	Svalbard
KS4	Swan Islands
ZS7	Swaziland
SL, SM	Sweden
HB	Switzerland
YK	Syria
UJ8	Tadzhik
VQ3	Tanganyika Territory
CN2	Tangier
VK	Tasmania
HS	Thailand
AC4	Tibet
CR10	Timor, Portuguese
FD	Togo
ZM7	Tokelaus
CR5	Tonga Islands
I1	Trieste
PY0	Trindade & Vaz Island
VP4	Trinidad & Tobago
ZD9	Tristan de Cunha & Gough Island
FB8	Tromelin Island
MP4	Trucial Oman
3V8	Tunisia
TA	Turkey
UH8	Turkoman
VP5	Turks & Caicos Islands
VQ5	Uganda
ZS1, 2, 4, 5, 6	Union of South Africa
K, W	United States of America
CX	Uruguay
UI8	Uzbek
HV	Vatican
YV	Venezuela
3W8	Vietnam
KV4	Virgin Islands
VP2	Virgin Islands, British
KW6	Wake Island
GW	Wales
FW8	Wallis & Futuna Islands
FF8	West Africa, French
PJ	West Indies, Netherlands
UA0	Wrangel Island
4W1	Yemen
YU	Yugoslavia
VQ1	Zanzibar

OFFICIAL A.R.R.L. COUNTRIES LIST
Courtesy of American Radio Relay League

A.C.E. RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

636 KING STREET NEWTOWN—LA7008

R. TV & H. '59 TV

21 inch 110 DEGREE

The complete kit of parts to R.TV & H. specifications and lay-out including: VALVES, TESTED STEANES TURRET TUNER & I.F. STRIP, TUBE MOUNTS AND MASK.

£105/0/0

WIRED AND TESTED £12/-/- Extra

FOR FRINGE AREAS

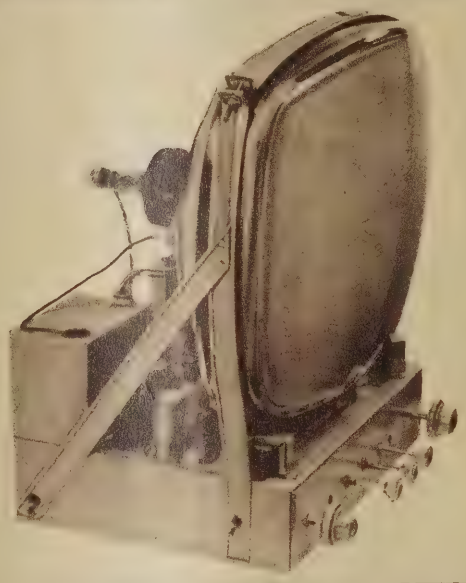
17 Valves, 4 stage Strip. Prealigned and tested.

PHILIPS NEW HIGH GAIN TUNER £107

Any individual parts, I.F. Strip, etc., can be supplied to order. Prices on application.

Chassis and E.H.T. Cage for R.TV & H. '59 TV Set £2/7/6.

Wired and tested Video Strip with valves—£11/15/



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Hi-coercivity tape, ex A.B.C. Stations
1200ft spools £1/12/6
500ft spools 19/6

TRANSISTORISED CAR RADIO

No power supply. No noise. Greater sensitivity. 12 volt operation. Complete with aerial, speaker. Simple installation.

£34/15/-

6 volt operation, £35/15/-
State aerial and speaker required.

TV ANTENNAES

A Complete Range from **£4/15/-**

AMPLIFIERS

Public Address Range 240v-AC

6 Valve, 10 watt, £14/17/6
6 Valve, 25 watt, £25/7/6
6 Valve, 40 watt, £32/7/6
7 Valve 20 Watt £22/17/6

Battery Operation

6 valve, 6v, 10 w. £18/15/
7 valve, 12v, 12 watt, £19/15/
7 valve, 12v, 25 watt, £24/17/6

BATTERY—AC OPERATION

6 Valve 6 x 240 10 watt, £20/15/
7 valve 12 x 240 12 watt, £21/15/
7 valve 12 x 240 25 watt, £29/7/6

STEREO RADIOGRAM KITSET

8 VALVE.
Dual Wave Stereogram, Octal Series Valves.
10 Watts Output.
2 Jensen 12in Speakers.
Bass and Treble Control.
Complete Kitset, including Valves, Speakers, Circuits.

£29/17/6

Wired and Tested.

£33/17/6

R.C.S. TRANSISTOR PORTABLE

Complete Kit including Moulded Plastic Cabinet. All parts including Battery.

£15/15/- plus tax

£19/13/9 nett

Or completely wired and tested.

£19/19/- nett

D.C. TO 240 V A.C. INVERTERS

6V Input 40 watts.
12V Input 60 watts.
32V Input 60 watts.

£9/17/6

6V Input, 60 watts, 50 cycles.
12V Input, 100 watts, 50 cycles.
Suitable for Radiograms, Tape Recorders.

£16/17/6

TV I.F. STRIPS

Complete with valves aligned and tested. Your pick from Steanes R.C.S. Mahood Coils.

from £11/15/-

200,000 L.P. 33 7in RECORDS

Presto disc. Latest Pop Numbers. Including My Fair Lady Hits, Rock 'n' Roll, Vocal, Dance Etc.. All New and Modern Numbers.

1/- EA. 6/- DOZEN

Postage, 1 to 12

N.B. No correspondence On This Special Line

STRAUSS 21in T.V. LOWBOY

16 valves and Diodes. 110 deg Picture in latest narrow-line lowboy consolette cabinet. Direct from manufacturer. Maple, walnut or rosewood cabinet.

Fully Guaranteed.

£108/-/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

21in PICTURE TUBES

90 or 110 degree. Fully guaranteed.

£23/15/-

TV TURRET TUNERS Q+ LATEST MODELS

£12/15/-

NEW 6V RELAYS

P.M.G. type 3000, 3 makes, 3 breaks.

7/6

POST 1/-.

STEREOGRAM CHASSIS

Dual Wave with R.F. Stage.
8 VALVE, 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8, 5Y3.
2 Rola 8MX Speakers.

£36/15/-

10 VALVE. 6BA6, 6AN7, 6N8, 12AT7, EM80, 2 x EF86, 2 x EL84, 5V4.
2 Rola 8MX Speakers.

£46/15/-

12 VALVE. Dual P.P. 14 watts output.
6BA6, 6AN7, 6N8, EM80, 2 x EF86, 4 x 6BM8, 12AT7, 5V4.
2 Jensen 12in Woofers,
2 Jensen 6in Tweeters.

£55/-/-

15 VALVE, 2 x 6BA6 6AN7, 6AV6, 6BR5, 2 EF86, 12AT7, 2 x 12AX7, x EL84, 5AS4.
4 Jensen Speakers.

£63/15/-

A.C. RADIO

Amplification Communication Electronics

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

AND 636 KING STREET, NEWTOWN — LA7008

EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956

DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42

AR8 Communications Receivers

12 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

NEW VALVES

12C8	12/6	AV11	3/9
6J8	17/6	6K7	5/
VT501	12/6	12SJ7	12/6
211	17/6	12SL7	12/6
1C6	12/6	6SH7	7/6
1J6	12/6	47	12/6
6A6	12/6	843	£1/10/
3A4	15/	957	10/6
3B7	10/	1625	£1
3D6	10/	1629	10/
304TH	£3/-/-	1619	£1
6AM5	15/6	9001	8/6
6AM6	17/6	RK75	10/
1K7	5/-	VR75/30	15/
1M5	5/	RK48A	£3
6X4	12/6	954	7/6
12AT7	17/6	VR105/30	15/
832	£2/10/	6AC7	5/
635	9/6	EL3NG	12/6
9003	12/6	2X 2-879	5/
6J6	15/	866A	15/
6J7G	7/6	6AJ5	9/6
6N7	10/	6SN7	12/6
KTW62/6U7	7/6	VR150/30	15/
1D5	7/6	6AK5	17/6
805	£3/-/-	9006	5/
6F6	12/6	6AS7	12/6
EF37	12/6	6A8	17/6
6X5	10/	CK1013	15/
6V6	12/6	6SA7	15/
6ES	12/6	6SL7	15/
12K8	12/6	6R7	7/6
1T4	10/	6AB7	12/6
1P5	7/6	EF39	12/6
803	£1/5/	EK32	15/
VT502	12/6	EBC33	12/6
1L4	5/	809	9/6
6K6	7/6	100TH	12/6
833A	£15	7F7	12/6

SENSITIVE RELAYS

Miniature 500 ohm operate on ½ Mil.

£2/10/-

NEW C.R.O. TUBES

Suitable for TV Pic. Tubes.

VCR 138A, 3in	17 6
VCR 97, 6in	17 6
5FP7 Flying Spot, 5in	17 6
CV112	10 0
CV1957	9 6
906	£1 7 6
5BPI	£1 7 6
5LPI	£2 17 6

NEW VACUUM PUMPS

An excellent Low Pressure Air Compressor, 7 c.f. per min., 25lb pressure.

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NEW POWER TRANSFORMERS

285 x 285 60mA	£1 12 6
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285 x 285 125mA	£3 7 6
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250 x 250 180mA	£3 17 6
295 x 295 300mA TV	£6 15 0
295 x 295 400mA TV	£8 5 0
115 700mA TV	£6 0 0
750 x 750 750mA	£7 10 0
240V to 110V 2KVA	£10 10 0
240V to 6V and 12 V, 1 amp	£0 12 6

Vibrator Power Transformers

6V 135V 35mA	£0 19 6
6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

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6V, 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
11 volts A.C.	£1
Hi-speed Polarised relay	£2/10/
400 ohm	12/6

Hi-lo Phono Transformers	4/6
Canadian Signal Lamps	7/6
Hi-voltage, Lead-thru Insulators each; 15/ doz.	1/6
Hydrometers, Battery Testers	5/9
Multi-strand 4-core Cable, yard	1/
100 yards	£2/17/6
Tx Var. Condensers, 300 pf	£1/5/
60pt with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5m'd 600 V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 4000V	35/
2mfd 2000V	12/6
2mfd 2500V	15/
4mfd 600V	6/6

A.W.A. STANDARD 3-GANG CONDENSERS

10/9

Postage 2/6.

GENEMOTORS

Input	Output		
24v.	250v. 100mA	£1 0 0	
24v.	550v. 375mA	£2 0 0	
24v.	250v. 60mA	£1 5 0	
12v.	500v. 350mA	£8 10 0	
12v.	1200v. 200mA	£6 10 0	
24v.	250v. 100mA. New	£2 0 0	
12v.	235v. 50mA	£2 15 0	
12v.	350v. 50mA	£2 15 0	
24v.	540v. 200mA. New	£2 15 0	
24v.	300v. 205mA. New	£2 15 0	

NEW 24V MOTORS

Series wound Hi-speed miniature. 12,000 R.P.M. £2/10/

Shunt wound with gearbox, 2 speed and 5 and 25 R.P.M. £2/10/

AMERICAN WALKIE TALKIE 536

Complete with valves, 1 crystal, coils. Good condition

£6/17/6

Postage 7/6.

Matched crystals and coils for 536 and 611 Units £2/10/ Per Set. Postage 1/.

WHIP AERIALS

3 Section 12ft

£1/2/6

VALVE & CIRCUIT TESTERS

Transmission Products Units. 240 A.C. 6v D.C. Includes Socket Modification Panel. Valve Charts. Tested. Perfect order.

£22/10/-

MINIATURE HI-POWER MOTORS

With Gearbox. 100 to 1 reduction, 24v. Reversing. Ideal beam swinging unit.

£2/17/6

AT5 TRANSMITTERS

Good order, 2 to 20 meg. Complete with valves.

£5/17/6

New Coils and Intermediates

Standard or minature to suit all valves

Coils B/C, 455 KC	9/6
Coils S/W, 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 meg.	4/6

£6/10/-

TELEPHONES

Standard P.M.G. Type. Pedestal Magneto Phones. Tested. In perfect order.

£6/10/-

AR7 COIL BOX

Band A only. Can be modified for other bands.

£1/9/6 ea.

WANTED

Communications Receivers. Test equipment, P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

DYNAMIC HEADPHONES

Low impedance **17/6**

Postage 2/6.

Dynamic microphones, type 7, 12/6 Postage 2/.

NEW 3BZ TRANSMITTERS

12v. operation, 2 to 10 Mgs. Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services. COMPLETE WITH 1 CRYSTAL.

£32/10/-

H.M.V. CRO. POWER SUPPLIES

350 v. 100 MA. plus 2000 V. Fully filtered.

£9/17/6

240V A.C.

TYPE S-POWER SUPPLIES

As used for AR8-AT5 Stations 575V 350mA plus 250V, 100mA Plus 12V DC 10amp. Tested New Condition

£18/17/6

HIGH POWER TRANSMITTING VALVES

Cat. 6, 12 KW For Industrial Heating.

£10/10/-

522 TRANSCEIVERS

Complete with Valves. Excellent Condition.

£12/10/-

522 Receivers. Complete with Valves **£5/17/6**

522 Transmitters. Complete with Valves **£7/15/-**

TYPE 46 TRANSCEIVERS

Small Pouch Type, Battery Powered. Locked Crystal Units. 3.5 to 9megs. Range to 10 miles. Complete with valves andi nstruction book.

£5/17/6

TYPE 18 TRANSCEIVERS

Lightweight Pack Set Batt. Powered. Variable Tuning 6 to 9 meg. Complete with Valves and Instruction Book. Range 10 miles.

£7/15/-

24V 1500 WATT GENERATORS

£10/10/-

522 TRANSMITTER OR RECEIVER CHASSIS

Less Valves.

£1/9/6

No. 19 TRANSCEIVERS

Complete with 15 valves and power supply.

£12/17/6

AMATEUR BANDS WITH BILL MOORE

AMATEUR CONVENTIONS POPULAR

Amateur Radio Conventions are becoming more popular each year. The major problem of organisers is to vary the program and maintain the interest of visitors. Particuar attelntion has been paid to this feature in the first event to be conducted in N.S.W. this year.

THE annual N.S.W. W.I.A. Divisional Convention will be held at the home of VK2WI, Quarry Road, Dural, on Saturday, January 30. The organising committee has gone to great lengths to ensure that this year's convention will be of a different character to previous events.

Greater attention will be paid to the true reason for conducting such events—to enable members to congregrate and discuss items of mutual interest and to gleam information that will be of value in the pursuance of their hobby.

The air of the show will be that of a country fair, activity all the time. Exhibits and demonstrations will run continuously showing the many and varied activities of the W.I.A. and its members in N.S.W. They will cover the VHFs, SSB, Mobile Working, Transistors, Old-Timers, SWL, etc. Catering for the most fastidious they will run for the afternoon session. The Blue Mountains section will be conducting a 144 Mc/s Blindfold Transistor Hunt continuously. This is an attraction that always causes fun, trials and a little tribulation to the winners.

The day will be in the form of a picnic for members and their families; afternoon tea and supper will be provided but they are asked to bring their own evening meal. Tea will be supplied, an 809 broached and coke for the kiddies, all at no charge.

Registration will be 7/6 per adult, kiddies free and will commence at 1 p.m.

This fee entitles all adults to participate in the large prize list which will be a feature of the show.

Disposal auctions will be in full swing and the night show will take the form of a mammoth quiz with mammoth prizes and it is felt a session that will often be recalled with pleasure.

Come along and swell the crowd. Visiting interstate amateurs and SWLs are particularly welcome to attend.

Among the equipment to be demonstarted will be a 150 watt 10 through 80 metres SSB transmitter. The 20-metre band will be used extensively during the afternoon and it is hoped to WAC during the afternoon. Publicity has been given the event overseas among the SSB gang. The VHF group will provide much transistorised equipment for demonstration and examination.

Organisers Ted Whiting, VK2ACD, and Max Pleffer, VK2MP, are working hard to see that the day will be interesting and instructive.

W.I.A. ACTIVITIES — N.S.W DIVISION

Dr Guetler's lecture at the November general meeting of WIA N.S.W. Division on "The Principles of Multi-Band Antennas and Methods of Feeding" and other antenna features provided much valuable information for members attending.

The doctor is Senior Lecturer in Electrical Engineering at the University of N.S.W. and an acknowledged authority on the subject. He cleared up a number of points for questioners at the completion of the lecture.

Besides multi-band antennas Dr Guertler covered gamma matches, folded dipoles and associated arrays.

Business discussed at the meeting included arrangements for the handling of nomination papers for Annual Elections following a notice of motion by Graham Hall, VK2AGH. Bill Clarke, Honorary Solicitor for the Division will now check all nominations immediately they are received. Forms for nomination will be forwarded with the Monthly Bulletin.

Most important was an announcement that the Council was completing the purchase of a property at 14 Atcheson Street, Crow's Nest for use as a permanent office for the Division.

With some slight alterations it will be possible to place all secretarial and general office equipment in this building, also to hold all gatherings except general meetings and house library and similar facilities. AOCP classes will be held there.

The location is central, only 100 yards from St. Leonards Station and close to buses and other transport. The club committee looked at the QTH aspect. It should be quite a good radio location. The building should prove a valuable asset to the Division.

It is hoped to obtain possession about the middle of January and all Divisional activity will be transferred there excepting VK2WI and general meetings.

Max Pleffer, VK2MP, takes over from Bob Godsal, VK2ARG, as a N.S.W. Divisional Councillor. Bob, during a number of years of service was the original organiser of N.S.W. WICEN in its present form and worked extremely hard to see the net firmly established. This work not only entailed operating organising but continued liaison with Civil Defence authorities to ensure the full value of such a net was realised. He, too, will be remembered for his 50 Mc/s operation from home, of VK2WI, and the effective relays.

Bob still continues for the year as the Division's Federal Councillor. Extension of business interests caused the resignation. Max has been active in Divisional projects and is assistant WICEN co-ordinator.

The committee are certain you will enjoy the convention; it will be different, a continued round of interesting events.

GOSFORD CLUB

The Gosford Radio Club, Central Coast section of the W.I.A., held their annual Field Day on November 22. N.S.W. had recorded inches of rain in most districts in past weeks but for this occasion was bathed in sunshine. The change undoubtedly helped the registrar to show over 100 amateurs present for a total attendance of around 300 persons. It was the largest gathering for such an event ever in the area and they were not to be disappointed as the facilities available to visitors have never been surpassed.

The first field event conducted in the morning was a 144 Mc/s Hidden Transmitter Hunt worked a shortest mileage basis with Jim Cummings, VK2PM, as the fox. Old stager, Ken Mitchellhill VK2ANU, was the eventual winner with G. Webster, VK2ZGW, in second place.

After this event a disposals auction was conducted at the Gosford Sailing Club where the Field Day was centred. Allan Williams, VK2FH, did the honours as his partner Alec Dan, VK2ABU, was reclining at Honolulu on the first leg of a world tour.

Lunch was then served and immediately afterwards the XYLs and Juniors left on a two hour launch trip around Brisbane Waters and the OMs on another 144mc/s search. Jim Cummings, VK2PM, was again the fox, a definite handicap in view of his repeated successes in this type of event. It was also based on a least mileage basis, but caused a problem to many, as only the more adventurous ventured along a road (?) for the shortest trip.

The transmitter although only a couple of miles airline from base and the shortest route about five miles, quite a number arrived by the long 20 miles and more sedate journey. Winner was Ron Graham, VK2ZBG, with Bob Winch VK2OA, a close second.

FIELD EVENT

The field event on the HF 7mc/s band a scramble resulted in a win for Dave Andrews, VK2AWZ, who tallied 21 contacts in half an hour and Jim Cummings VK2PM, second with 20 QSOs.

The Quiz for the gentlemen, those with brains, resulted in a triple tie for first.

Ted Whiting, VK2ACD, Max Pleffer VK2MP, and Stan Bourke, VK2EL, all received prizes. Mrs Agar was a clear winner amongst the ladies.

Back at the sailing club more disposals were auctioned, prizes presented and fond farewells taken.

The whole event was a credit to the organising body, the Central Coast Section. All officials did a great job in seeing the show was run so smoothly. Their ladies too were marvellous, dispensing the eats etc.

Prominent were the president Major Collett, VK2RU and his wife and secr

tary Reg Brooks, VK2AI. Events of this nature in such a central location, attracting visitors from both Sydney and Newcastle, do much to cement the fellowship of Amateur Radio.

ITU CONFERENCE

John Moyle, VK2JU, arrived back from the ITU Conference on November 23, and amateurs await with interest the final report on the conference's actions as they affect Amateur Radio.

Unfortunately John, during the latter period of his stay overseas was not in the best of health and was admitted to hospital a day after his return. The final report will naturally be delayed. Amateurs in Australia wish John a speedy recovery and a return to good health.

HUNTER BRANCH

Lecturer at the November meeting of the N.S.W. Hunter Branch was Stuart Fairburn, VK2ZDL, who covered a range of subjects in "gleanings from his notebook." This journal, produced on the least provocation, contains a multitude of ideas and the 30 members present enjoyed the discourse.

Keith King, VK2ANK, recently returned from Japan, described his trip for members of the N.S.W. Blue Mountains section at their November meeting. It was an eventful one, being shipwrecked off the Japanese coast in the process. Keith produced tapes of the noises of the storm and pieces of equipment collected. As an individualist, his brushes with various officials recounted were well worth hearing. Members enjoyed the change from normal meeting routine.

SWL SECTION

The S.W.L. section of the N.S.W. Division, comprising over 150 members, have formulated their ideas on suitable S.W.L. operating awards. This was a job allotted them and a full report will be forwarded to the Federal Executive of the W.I.A. Covering overseas and local listeners awards will be welcomed by the many short-wave listeners. Most amateurs graduated from the S.W.L. ranks and encouragement to listeners is an important function of W.I.A. activity.

Amateurs must remember that the awards will only become available to S.W.L.s if they can produce the confirming QSL cards, so reply to listeners' cards to assist them to gain their operating awards.

Section secretary, Tim Mills, VK2ZTM, presented a recorded report of the action on S.W.L. awards over VK2WI.

DX COUNTRY

Latest DX country on the DXCC list s Willis Island, a meteorological station ome 300 miles off the coast of Queensand, and there is some reaction to the isting. A lot more comment was record- d to adding of Serrana Bank, so small hat experienced navigators had trouble nding it. Leading English DX exponent eter Pennell, G2PL, has requested that is name be deleted from the DXCC lonour Roll in protest to some of the ecent additions to country status.

At this stage it does not seem very nportant what obscure places are listed -let us have plenty of them. What a imax when a leading DXer contacts em all—nothing would be left in life for him, no further midnight oil burning, all the fun of DX would be gone. Quite a number are fast approaching the ultimate incidentally. Some of the DX gang might be forced to the VHFs for diversion.

If you still have an interest in DX or DX contacts an article well worth reading appears in October QST.

It is written by DX specialist Katashi, KH6IJ, who knocks them over at high speed in DX contests especially the ARRL's version. 120 contacts an hour often peaking at three a minute. It is an absorbing article for operators.

50 Mc DX

The sporadic "E" season on 50 Mc/s opened later than last year and first consistent openings appeared in late November. VHF enthusiasts were pleased to learn that the P.M.G.'s Department had granted a further extension of 12 months for amateur use of the 50 Mc/s band. In the event of the segment being required for Channel 1 TV, amateurs will be given 14 days to move back to 56 Mc/s.

Late in November the band really opened and all east coast States and Tasmania and South Australia amateurs logging contacts.

The VK2, 3 and 5s were among the JAs in one good opening earlier in the month.

VK Zero CC will operate on 50 Mc/s later in the summer using 50.19 Mc/s and is anxious to arrange schedules with other VK stations.

N S.W. WICEN

Early in November the N.S.W. WICEN organisation was again alerted. Floods were threatening on the North Coast of N.S.W. Many stations in the area reported in to the WICEN zone officer, Noel Hanson, VK2AHH. Fortunately the weather abated and no serious flooding occurred. The net spent some time passing news of the weather, river heights, etc., to the Bellingen centre.

It takes very little time for the net to swing into operation. Most of the members on the North Coast are well experienced in emergencies.

The record of these amateurs in such working is well acknowledged.

YL LEAGUE

The Young Ladies' Radio League celebrates the twentieth anniversary of its foundations this year.

The League membership now comprises more than 900 YLs in 30 countries. Of interest to all amateurs in the world are the operating awards sponsored by the League and available to all. OMs with a yen for contacting YLs can have an interesting time qualifying for these awards.

The most popular is the YL Century Certificate and is available to all amatures. They must submit proof of contact with 100 different licensed YL operators anywhere in the world. All contacts must be made from the same QTH or within a 25-mile radius.

One hundred QSL cards or other written communications from the stations worked confirming the necessary two-way contacts must be submitted.

Other details required are the names

(Continued on Page 97)

TEST EQUIPMENT AND AMPLIFIERS TO R. TV & H. DESIGN

STEREO

Mullard 2 Stereo chassis box in heavily plated dichromate steel, 40/ plus 25 p.c. S.T. Front plate printed with all graduations, 19/6.

R. and H. Low Input Stereo Preamp. Box heavily dichromated, 59/6, plus 25 p.c. S.T. Engraved front plate in burnished aluminium with dark red figures, 40/, plus 25 p.c. tax.

R. and H. 10 watt or 17 Watt Stereo chassis heavily dichromated, 45/, plus 25 p.c. tax.

R. and H. Stereo Radiogram chassis heavily dichromated, 45/, plus 25 p.c. tax.

Cases and chassis made to your own specifications.

TEST EQUIPMENT

R. and H. Sweep and Marker Generator case, all chassis printed front panel, £5/18/6, plus 12½ p.c. tax.

R. and H. Wide Band Scope case, all chassis printed front panel, £10/19/6, plus 12½ p.c. tax.

R. and H. Senior VTVM case chassis front panel printed, £4/13/6, plus 12½ p.c. tax.

R. and H. Bench type VTVM case chassis printed front panel, £2/14/, plus 12½ p.c. tax.

R. and H. Audio Signal Generator case chassis and printed front panel, £4/13/6, plus 12½ p.c. tax.

R. and H. RC Bridge case chassis and printed front panel, £3/4/6, plus 12½ p.c. tax.

R. and H. Audio Distortion Meter, case, chassis and printed front panel, £3/4/6, plus 12½ p.c. tax.

R. and H. Simple Pattern Generator, Case chassis and printed front panel, £3/4/6 plus 12½ p.c. tax.

Any of the above with Engraved front panel, £1/15/ extra.

TEST EQUIPMENT

FRONT PANELS

Engraved front panels for any of the above. 50/, plus 12½ p.c. tax; printed, 19/6, plus 12½ p.c. tax.

INSTRUMENT CASES

Finished in grey baked hammerdok.
R. and H. type, MC 5A 9 x 6 7/8 x 5½, 22/6, plus 12½ p.c. tax.
MC 82A, 13 x 8 x 6 7/8. 40/, plus 12½ p.c. tax.
SF 7A 7½ x 7¼ x 7¼ for bench type VTVM, 22/6, plus 12½ p.c. tax.

Cat. No.	Long	High	Deep	Price plus 12½ p.c. tax
MC 6	6	6	6	15/-
MC 7	10	8	7	22/6
MC 67	12	7	6	24/-
MC 81	10	10	8	29/-
MC 811	12	11	8	39/-
MC 79	15	9	7	50/-

SLOPING FRONT CASES

SF 7	7	6½	7¼	22/6
SF 79	9	6½	7¼	27/-
SF 71	11	6½	7¼	32/6
SF 8	13	8	8	39/-
SF 10	18	10	10	50/-

Chassis of 16-gauge Aluminium can be supplied for any of above, all prices plus postage, and slightly higher interstate.

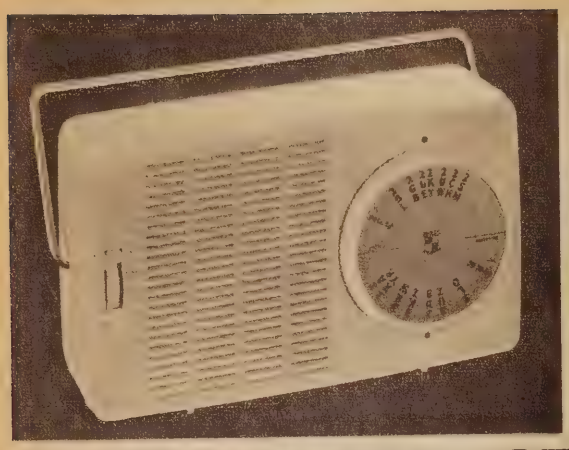
MacKinnon and Nicholls Pty. Ltd., 468 Collins St., Melbourne.

Martin de Launay, Newcastle.

Chandlers Pty. Ltd., Charlotte St., Brisbane.

R. H. Oxford & Son Pty. Ltd.

97 Marriott St., Redfern, Sydney. MX3764.



Build this beautiful TRANSISTOR PORTABLE

Ivory and gold cabinet with handle.
Dimensions 6½" x 4" x 2."

COMPLETE SET OF PARTS –

Including LARGE LONG LIFE BATTERY

All you need is solder and a small soldering iron.

FULL INSTRUCTIONS—MAKE IT IN ONE EVENING.

FULL INSTRUCTIONS

***Price* £15/15/0** Plus 25% Sales Tax

GUARANTEED RESULTS

BUILD ONE FOR CHRISTMAS

or we will build it for you for a small extra charge.

R.C.S.

R.C.S. Radio Pty. Ltd.

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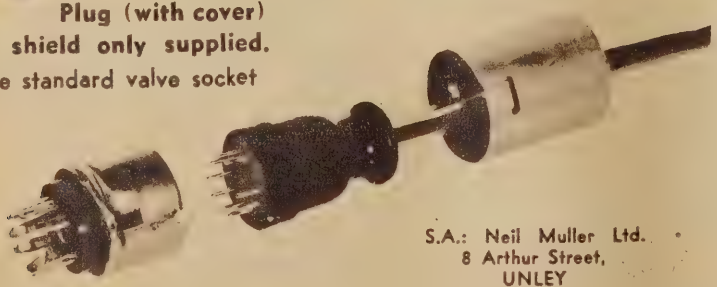
LW3491-5385

NINE PIN NOVAL PLUG

Shielded

Plug (with cover) and shield only supplied.
Use standard valve socket



Plug (with cover) only

Fits standard 9 pin valve socket. Pins silver plated.
NOTE Lashing Bollard.

N.S.W.: Jacoby, Mitchell & Co. Pty. Ltd.,
469 Kent Street,
SYDNEY

S.A.: Neil Muller Ltd.
8 Arthur Street,
UNLEY

TAS.: Homecrafts (Tas.) Pty. Ltd.,
220 Elizabeth Street,
HOBART

W.A.: D. K. Northover & Co.
115 Murray Street,
PERTH

available from all leading wholesalers and radio parts suppliers

Manufactured by . . .
ZEPHYR PRODUCTS PTY. LTD., 58 HIGH STREET, GLEN IRIS, S.E.6., VIC.
TELEPHONE: BL1300, BL4556.

AMATEUR ACTIVITIES IN THE U.S.

Violent would best describe the reactions in the U.S. amateur journals' correspondence columns to a suggestion that the maximum power of stations over there be raised from one to ten kilowatts. There is even considerable support in that country for a general reduction in power in view of the ever increasing QRM problem as the amateur population grows.

New techniques in transmitter and receiver design have alleviated the worry to some degree.

However it would appear that the natural growth is outstripping the advantages of these advances.

A questionnaire conducted among radio clubs in the U.S. shows a continued rise in the number of operators using SSB. This year (1959) the figure is 6.36 per 100 amateurs active. Over the last three years the growth has been approximately one per cent each year. An interesting point from "The Sidebander" shows the MP4QAO of Qatar, an AM operator, did not hear a W AM signal for just on six months. Plenty of SSB signals however have been received on both 14 and 21 Mc/s.

ARRL Station and Leadership appointments available to amateurs cover a wide field of interests.

Appointments to these special groups offer an incentive to amateurs and an outlet in a phase of special operation. Special certificates are issued to members of the groups. Some typical allocations and duties are listed below:—

O.R.S.—Official Relay Station—Reliable traffic service, high procedure standards and a 15 W.M.P. Code requirement.

O.P.S.—Official Phone Station—Voice operation using exemplary operating procedure and affording dependable traffic facilities on voice.

O.E.S.—Official Experimental Station —Experimental operating on VHF, UHF or SHF bands. Reporting on propagation conditions and supporting VHF nets.

E.C.—Emergency Co-ordinator — Recruits and organises amateurs of a community or other area for emergency radio service. Sponsors tests, arranges liaison with officials and agencies served, also with local communication facilities. Assists in Radio Amateur Civil Emergency Services (RACES) implementation.

O.B.S.—Official Bulletin Station — At least three times a week transmits ARRL and FCC information in Radio Bulletins to amateurs.

O.O.—Official Observer — Sends cooperative notices to amateurs to help them catch and correct signal difficulties. Assist in frequency observance, insure high quality signals and prevent trouble for them with the F.C.C.

THIRD PARTY

THIRD party traffic handling, a privilege not available to most amateurs of the world, has been extended for U.S. operators. In countries where the telephone system is a governmental department traffic handling is always forbidden.

The U.S. amateur as from September can pass traffic for a third party to similar stations in Mexico.

Many W amateur stations spend their whole operating time handling traffic into the various nets that are active for the purpose.

Some of the monthly totals of traffic handled reach vast proportions. W3CUL, for instance, in May handled 8,094 messages, 317 originated, 3,957 received, 3,251 relayed and 569 delivered. During that month no less than 14 W stations were recorded as handling more than 1,000 messages. These were single operator stations another three, more than one operator stations, passed the 1,000 mark. It is required that all messages be handled on amateur frequencies and within 48 hours of receipt for A.R.R.L. listings.

TECHNICAL GLASS

TECHNICAL class licensees in the U.S. may now use a portion of the 144 mc/s band from 145 to 147 mc/s. This segment has previously been available for novice class operators.

This is the first allocation granted that permits these two classes of licensees to communicate.

Many arguments were advanced in favour of such a grant, including extended civil defence working, populating of the band and the provision of a band less susceptible to T.V.I. It will provide technicians with an opportunity of increasing their code speed by working with novices and so assist to eventually qualify for a general class licence with H.F. privileges.

W11CP's latest contribution for the novice licensee in Q.S.T. is a 75/100 W.A.H. crystal-controlled transmitter. It is an inexpensive job using cheap surplus (disposal) tubes and parts scrounged from a TV set! It's a changing world, but so far the time has not arrived here for such activity. Quite a proposition in the U.S., an unserviceable TV receiver can be picked up for five dollars or so and are often just given away.

YL LEAGUE NOTES

(Continued from Page 95)

of the operators alphabetically arranged and the date and time of the contact.

Cards, etc., should be submitted direct to the Y.L.C.C. custodian plus sufficient postage to cover the return of the certificate by first-class mail.

Endorsements are issued for confirmed contacts with each additional 50 YLs. Award custodian is Katherine Johnson, W4SGD, Box 666, Furquay Springs, North Carolina, U.S.A.

Other awards include the Worked All States/YL. Proofs of contacts with a YL operator in each of the 49 States.

This award parallels the ARRL's WAS. QSL's should be sent to the Custodian, Grace Ryden, W9GME, 2054 N. Lincoln Ave., Chicago, Illinois, U.S.A. xA list of contacts must accompany the cards and sufficient postage to cover their return.

The third operating award is Worked All Continents/YL. Proof of a contact with a licensed YL operator in each of the six continents must be submitted. They should be sent to Barbara Houston, K zero LYV, general delivery, Richardson, Texas, U.S.A. (Temporary address only). IRC's or their equivalent must be sent with the confirmations to finance their return by first class mail.

AWA RONETTE
MICROPHONES & ACCESSORIES

Type R572
£19/3/3
High Impedance
Type R572/L
£25/3/3
(low impedance, 200 ohms) duo cell omnidirectional. Other types also available from
NEWTON McLAREN LTD.
17 LEIGH ST., ADELAIDE.
and leading wholesalers

IS RADIO YOUR HOBBY?
If so . . .
STOTT'S CAN HELP YOU
Our short Home-Study Course in Radio for Amateurs meets the exact needs of Servicemen, Radio Salesmen, Amateurs, Dealers, Builders of Sets, and others who are interested in Radio as a hobby.
Students testify to the thorough training and invaluable help obtained from this splendid Radio Course. It will pay YOU to study at STOTT'S.
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159 Flinders Lane, Melbourne; 149 Castlereagh St., Sydney; 290 Adelaide St., Brisbane; 21 Grenfell St., Adelaide; 254 Murray St., Perth.
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My Name .....
Address .....
..... Age ..... (R.H. 160)

AWA RONETTE
MICROPHONES & ACCESSORIES

Type R474
£28'9'10
Studio type, 4 cell omnidirectional. Technical pamphlets will be mailed on request.
CHANDLERS PTY. LTD.
Albert and Charlotte Sts., BRISBANE.
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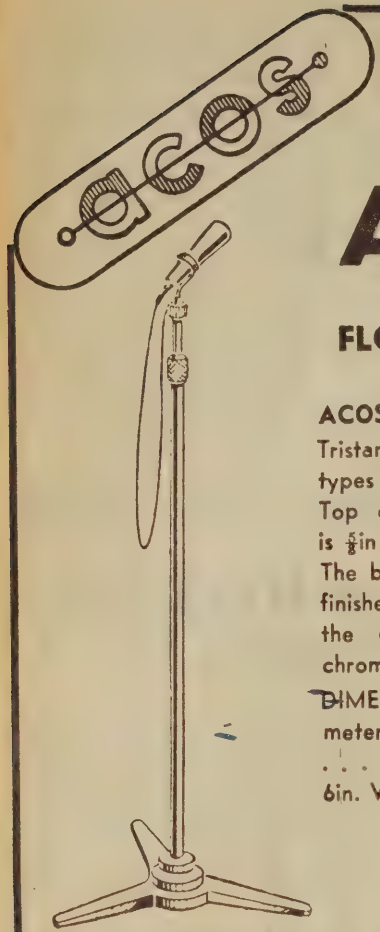
MICROPHONES AND FLOOR STAND

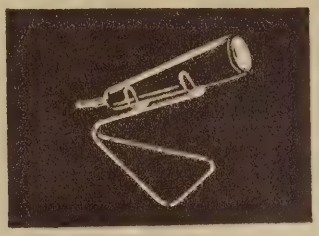


ACOS FLOOR STAND

Tristand for use with all types of stand microphones. Top of the extension arm is ⅝in x 26 TPI std. thread. The base and lower tube is finished in silver varitone, the extension arm being chromium plated.

DIMENSIONS: Base diameter . . . 17 inches. Height . . . Min. 3ft 3in. Max. 5ft 6in. Weight . . . 11 pounds.

PRICE £5-6-0.



CRYSTAL STICK MICROPHONE, MIC39-1

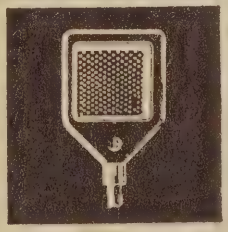
The MIC39-1 has been beautifully styled as a hand, desk stand or floor stand unit, and precision engineered to the highest professional standards. A heavy die-cast liner in the microphone case eliminates the possibility of hum pick-up due to hand capacity effects. The use of a special noise-free cable improves screening and gives a greatly increased signal-to-noise ratio. Designed especially for high quality recording, broadcasting and public address work.

PRICE £8-19-6, complete with desk stand.

CRYSTAL MICROPHONE MIC40

The MIC40 has been pleasantly styled in a variety of two-tone colours to give a handsome quality Microphone of modest dimensions and unassuming price. Ideal for tape recorders with a minimum of stowage space available, and a wide range of domestic applications.

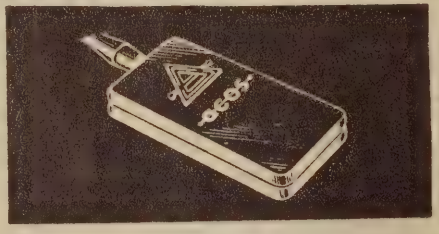
PRICE £3-19-6.



LAPEL MICROPHONE MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft moulded rubber case which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel.

PRICE £5-19-6



STRINGED INSTRUMENT AMPLIFIER, TYPE VP1.

The VP1 Vibro-Voice has been specially designed for use with guitars, double bass and in fact all stringed instruments. With the use of this simple yet effective pick-up together with a good quality amplifier any instrument can be amplified. The VP 1 has an ample output and a frequency range which extends to approx. 5 K/cs. The tough rubber case protects the instruments from damage. Easily connected to the PU input of your amplifier or radio with a resistance of 5 megohms in series with the inner core of the cable.

PRICE £7-15-0.

ACOS PILLOTONE

Replaces irritating headphones and enables the individual listener to relax, head comfortably settled on a cushion or pillow. Although giving the reproductive qualities of a normal loudspeaker the Pillotone is inaudible three yards away. The tone has been specially compensated to give perfect reproduction, the muffling effect of the pillow provides the correct base response. Apart from domestic use the Acos Pillotone is ideal for hospitals and can be completely immersed in disinfectant without harm to the unit.

PRICE £6-10-0.

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD.

101 Pyrmont Bridge Rd., Camperdown.
Sydney, N.S.W. Phone LA 6124.

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

ON SHORTWAVE BY ART CUSHEN

EXPANSION OF FIJIAN SERVICES

The Fiji Broadcasting Commission have announced that two 10,000 watt transmitters are soon to relay the three language program through out the Colony.

THE Fiji Broadcasting Commission has only been established five years and it has, since then, operated with three broadcast bands and one 500 watt shortwave transmitter VRH4, using 3980Kc.

The original plans for transmissions were made by a B.B.C. engineer, who advised on the station's technical requirements, but its recent progress has enabled more high-powered equipment to be brought to cover the remote parts of the colony.

The present plans were suggested by the chief engineer of the New Zealand Broadcasting Service, who made a comprehensive survey of reception conditions in the Fiji group.

30-ACRE SITE

A 30-acre site eight miles from Suva will be the home of the new station and plans are now being called for the two new transmitters, which will be in service within two years.

It is planned to install a new receiving station at the site of the new station, as the F.B.C. relays many B.B.C., Radio Australia and Radio New Zealand features. The shortwave transmitters are expected to use low frequencies, and band changes, to suit the reception problems in the colony, are also expected to be made.

F.B.C. has its income from both radio licences and commercial programs, and carries the programs in English, Fijian and Hindustani. The station will use a vertical incident type of transmission from the new Naulu, eight miles from Suva.

This type of transmission is of special use in the tropics in providing good reception confined to the smallest area and it should provide strong signals throughout the colony.

EUROPEAN SIGNALS

Some fine European signals are reported from our reader, K. W. Ross, Warrnambool, Victoria; these include the reception of Sofia on 9,700 Kc. from 2 to 2.30 p.m. Belgrade on 6,150 Kc. in the European transmission has English from 4.30 to 5 a.m. Sweden on 7,210 Kc. in their European session heard from 6.30 to 7 a.m. Madrid on 6,130 Kc. and also 7,100 and 9,638 Kc. has been well received from 6.20 to 6.50 a.m. Paris in English on 6,045 Kc. is tuned from 6 to 6.30 a.m. Other signals noted in Victoria included Baghdad with English on 6,030 Kc. from 6 to 6.30 a.m., Djakarta on 7,270 and 3,960 Kc. with an English program to South-East Asia from 10.30 p.m. to 11 a.m. Voice of Indonesia on 9.585 and 7,270 Kc. tuned from 9 to 9.58 p.m. to Australia and New Zealand.

Colombo in Ceylon has been tuned on 9,520 Kc at 2 a.m., while WRUL in New York appears on 17,755 Kc. at 10 a.m. Delhi in its transmision from 5.45 to 6.45 a.m. is heard on 11,710 Kc. with programmes to Europe. Karachi in Pakistan is using 7,010 and 9,680 Kc. from 5 to 6 a.m. African signals heard include Tanganyika on 5,050 Kc. with B.B.C. news at 4 a.m., while Nairobi in Kenya is heard on 4,885 Kc. at the same time.

VLY25 MELBOURNE

A new transmitter for Radio Australia, Melbourne, with the callsign VLY and using 10,000 watts is soon to commence test transmissions. The frequency 25,735 Kc. is to be used and, with that channel, the call of VLY25 will be used. The experimental broadcasts will be during daylight hours and, naturally, will not be of a regular nature. The plan is for a relay of the programmes of VLD21. The station is to be on the air from 8.15 a.m. to 7.15 p.m., on 25,735 Kc.

ZYE21 ON 15,245 Kc.

Reception of the new Brazilian station on 15,245 Kc. has been noted during the mornings with sign off at 11.50 a.m. The station has a program of news in Portuguese at 11.30 a.m. and, after a short musical number and some commercial announcements, identification is given before broadcasting is concluded.

The station has been testing recently and uses a power of 1,000 watts during day and 10,000 watts during night time transmissions. The address of the station is P.O. Box 491, Belem, Brazil. The station uses the slogan "Radio Marajuaba," which is heard frequently during its broadcasts. Reports from listeners have been requested and announcements to this effect have been made in both Portuguese and English.

FLASHES FROM EVERYWHERE

HOLLAND is soon to have a commercial service but this one will be with a difference, as the Dutch Government does not permit commercial radio in Holland. The new service will be broadcast around the clock and from a ship eight miles off the Dutch coast. The 5,000-watt transmitter will operate in the 31 metre band according to a Danish report, and is expected to commence operations shortly.

URUGUAY has several new stations, which have recently commenced operation reports World Radio Handbook and possibilities of reception of the broadcasts in this area are bright.

CXA73 at Montevideo is on 6115Kc, from 10 p.m. to 11 a.m. with 5,000 watts. CSA53 on 6055 Kc, with 50,000 W. from 8 p.m. to 1 p.m. CXA64 at Melo, with 25,000 W. from 11 a.m. to 1 p.m.

MOROCCO station Radio Rabat has a new frequency for its news service in English; this is now broadcast on 15185 Kc. The English news is broadcast each day from 9.15 to 9.30 p.m.

TEHERAN station which broadcasts on 15120 Kc, though this is announced as 15100 Kc, continues to be widely heard in Europe. The station is heard from 6.15 to 6.45 a.m., with English. On Monday mornings it is noted that sign off is 6.30 a.m. without identification, and Radio Australia reports the sign off is with a clock chiming 12, and then an anthem.

DACCA station of Radio Pakistan has been heard on a new 13 metre frequency, 21685 Kc and is on the air from 3 to 5.30 p.m.

AHGHANISTAN has moved its frequency for the European service from Kabul, and the broadcasts are now heard on 7285 Kc. Radio Kabul operates from 4.30 to 5.00 a.m. in French and from 5 to 5.30 a.m. in English.

PORTUGAL's transmission to the Far East is, at the moment, being received at fair strength on 21495 and 17880 Kc. The period of English broadcasting is from 11.45 to 12.30 a.m.

ISRAEL with the broadcasts of "The Voice of Zion" now is using two frequencies, on 9009 Kc and 9730 Kc. The program is heard with French at 5.30 a.m., Hebrew at 6 a.m., Russian at 6.15 a.m. and English at 6.30 a.m., with the station closing at 7 a.m.

BRUSSELS broadcast in English is now confined to the Belgian Magazine program, which is of 30 minutes duration. The session is broadcast Monday, Wednesday and Friday from 8.30 to 9 a.m., on ORU3 11850 Kc, ORU4 15335 Kc, and ORU5 on 11720 Kc. A further broadcast on Sunday, Monday, Tuesday, Thursday and Friday from 10.30 to 11 a.m., when using ORU3 11850 Kc and the Leopoldville Belgian Congo relay OTC using 9655 Kc. On Sunday another session is broadcast from 9.15 a.m. to 11 a.m. and uses ORU3 11850 Kc and OTC on 9655 Kc. The address of the station for reports is Belgian National Radio, P.O. Box 23, Brussels, Belgium.

BRAZZAVILLE station Radio Equatorial Africa has been providing very good reception in North America on its 9545 Kc outlet. The station comes on the air at 2.30 a.m., and carries a program in French. Brazzaville's other station "The Voice of France in Africa" gives good reception at 2 a.m., when they use the 11725 Kc outlet, and again at 7 to 8.45 a.m. on a new frequency of 9765 Kc. On this latter channel news in French is at 7 a.m., and the program is also relayed on 11725 Kc.

CAIRO has again been heard on 17915 Kc with a program in Arabic at 10 a.m. The station carries French for listeners in Algeria at 11.45 a.m.

OMDURMAN in the Sudan has been heard on two new frequencies in the

(Continued on Page 103)

NEW *Releases!*

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF MONAURAL AND STEREOPHONIC EQUIPMENT

Stereophan LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

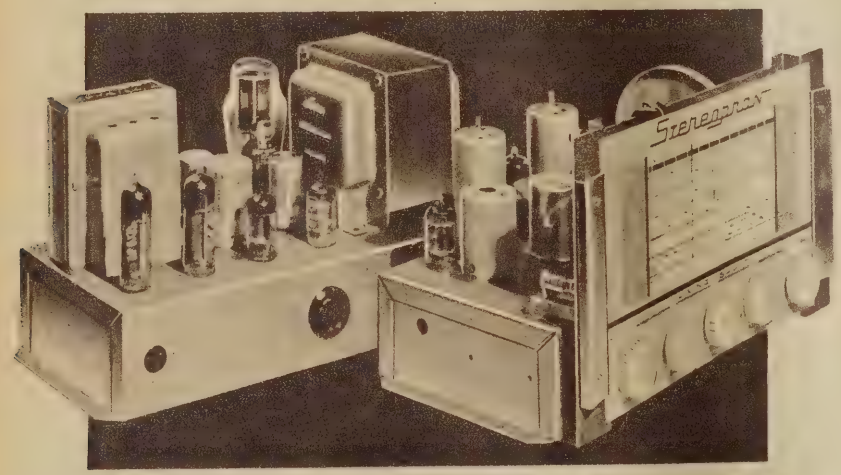
10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£48/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 3-3" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles.

£38/15/- F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

SPECIFICATIONS ON OPPOSITE PAGE

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT. Frequency response 40-13,000 cycles. Max. output 10 watts.

£42/15/0 F.O.R.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST.

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short-wave bands.

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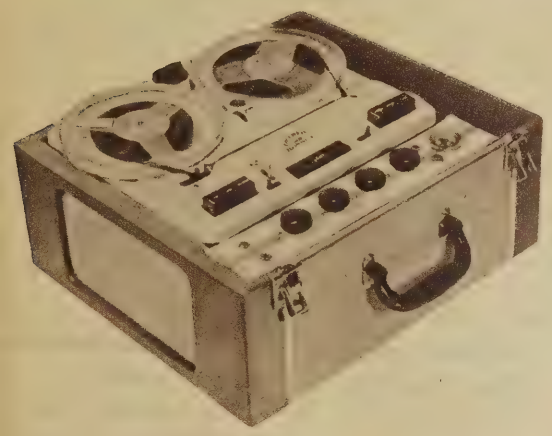
ALL CHASSIS GUARANTEED FOR A PERIOD OF SIX MONTHS. ALL 4-SPEED STEREO RECORD CHANGERS AND PLAYERS STOCKED.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

Buying a Tape Recorder?

First see and hear the new Hi-Fi Recorder by Classic incorporating the new Collaro Mark IV Transcription deck. The only deck with ALL these features.



THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The seven-valve amplifier, including level indicator, incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Record monitoring and outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with perspex dress plate to match deck.

- **HIGH FIDELITY**
Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
Instantaneous changes can be made from one track to the other. Fast rewind in either direction.
- **CONSTANT TAPE TENSION**
A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
3¾, 7½ and 15 inches per second.
- **FOUR HEADS**
Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track.
- **TWIN TRACK OPERATION**
One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 to 1.0 per cent.
- **TWO MOTORS**
Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

COMPLETE RECORDER WITH MIKE — 84 GNS. f.o.r.

DECK WITH AMPLIFIER, POWER SUPPLY and 6in x 9in SPEAKER, 71 GNS.

AMPLIFIER AND POWER SUPPLY FOR COLLARO DECKS WITH VALVES (7) £34/10/- f.o.r.

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive 'magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

THE WARBURTON FRANKI PAGE

STEREOPHONIC SOUND W.F. for the latest and best Stereophonic Cartridges—Amplifiers, Pick-ups. Full details on request.

HIGH QUALITY AMPLIFIER ALL CAN AFFORD
The W.F. 4-watt Amplifier will give superb reproduction from any of the popular pick-ups. An output transformer to suit speakers from 2 to 4 ohms, or 15 ohms impedance is built in. Please specify impedance required. PRICE — complete ready to use **£16/19/6.** Freight: Vic., 2/9; Int., 6/; or complete kit set to build your own—14 gns. Freight: Vic., 2/9; Int., 6/.

METERS First quality 4in square meters 0-1mA with plain or multimeter scale. 100 ohms resistance 95/ plus 12½ p.c. tax. Also 0-500 micro-amps, 95/ plus 12½ p.c. tax; 0-500 micro-amps, 135/ plus 12½ p.c. tax. Pack. and Post., Vic., 1/; Int., 2/6. 1mA rectifiers, 12/6 plus tax. Post free.

TOP PERFORMANCE—MAGNAVOX LOUDSPEAKERS

Type	Size	Watts	Frequency Range	Price	Post Vic.	In
HF5	5in	4	130-10 K.c.p.s.	£2/15/11	1/10	3/
6WR	6in	6	30-15 K.c.p.s.	£6/10/-	1/10	3/
8WR	8in	7	30-15 K.c.p.s.	£7	2/3	3/
12WR	12in	10	30-15 K.c.p.s.	£7/9/7	2/11	4/

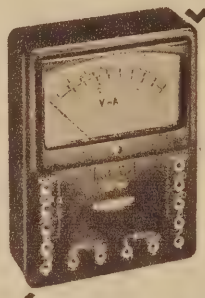
The above Speakers are available with Voice Coil Impedance of either 2 or 15 ohms. 2.7 ohm Transformers are available to suit all types fro 500 ohms to 14,000 ohms. C.T., **30/9 each.** Pack and Post Vic., 1/1 Int., 3/. Special Voice Coil Impedances available to order at a slig extra charge.

RECTIFIERS All Selenium types made to order fro American "International" Plates and Components. One ty available from stock is rated at 12 volt 6 amps and is su able for battery charging, etc. Size of plate is 3in squa and overall size over terminals and mounting screw is 3½ x 3½in. Price 65/. Pack and Post, 1/3.

SOLDER THE EASY WAY WITH SCOPE SOLDERING IRON
Heats in a few seconds from transformer or car battery. Spare parts always in stock; Scope Iron 50/. Pack. and Post., Vic., 1/; Int., 2/6. Spare Tips 10d each. Spare Carbon Elements 1/ ea. Transformer to suit 47/11. Pack. and Post., Vic., 2/; Int., 3/8.

PRONTO SOLDER GUN
Hold in the hand like a revolver. Inbuilt Transformer uses piece of Tinned Copper Wire as bit. Nothing to wear or burn out. £5/4/.

AUTOMATIC SOLDER FEED ATTACHMENT 25/-



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Ranges
D.C. Volts 0/10/250/500/1000
A.C. Volts 0/10/250/500/1000
D.C. Current 0/1/250mA
Resistance 0/10/100K ohms
Sensitivity 1000 ohms per volt
Packed in Box with Test leads and instructions **89/6**
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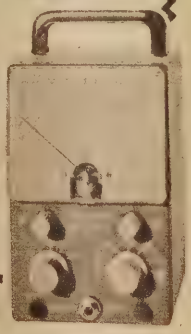
BUILD YOUR OWN V.T.V.M. with Famous American HEATHKIT V-7A ... World's Largest Selling V.T.V.M. Kit

Specifications: DC Volts:—7 ranges 0-1.5 to 0-1500. Input resistance—11 megohms. Sensitivity—7,333,-333 ohms per volt on 1.5V range. Accuracy plus minus 3 p.c. full scale. AC Volts:—7 R.M.S. Ranges 0-1.5 to 0-1500. Frequency response (5V Range) plus minus 1 DB. 42 C.P.S. to 7.2 M.C. Accuracy plus minus 5 p.c. full scale. 7 peak-to-peak Ranges 0-4 to 0-4000. Resistance 7 ranges —measures .1 ohms to 1000 megohms with internal battery. Size—7 3/8in x 4 11/16in x 4 1/8in. Weight 7 lb.

Price £27/10/ plus 12½% S.T. Post Vic. 3/9; Int. 8/4.

Easy Terms—£6/18/9 deposit and 45/ monthly for 12 months.



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S4	25 watt	42
A1	40 watt	30
S1	55 watt	38
A2	60 watt	39
A4	80 watt	44
A6	100 watt	49/
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Famous make Turnover Cr tal Pick-ups. To clear at l than the price of the Cartridge alone ... **39/**
Pack. and Post, 2/.

MICROPHONES
Crystal Lapel type, comp with lead. 30/ ea.
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GOLDRING DIAMOND STYLI. New Reduced Prices

MONOPHONIC (For L.P. records only)

D 16	Acos HGP. 37-IC	£4	0 0
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D/32	Dual D.N.2	£5	10 0
D 35	B.S.R. TC.8M ..	£4	0 0
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D/35/S	B.S.R. TC.8/S .	£4	0 0
D/44	Ronette Stereo ..	£4	0 0
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D 50	(Stereo Only) Goldring 700	£7	0 0

EXPANDED ALUMINIUM Available either Plain (Silver Finish) or Anodised (Gold Finish). Maximum size Sheets 4ft x 3ft. Any size cut to order. Plain 12/ sq. ft. Anodised 19/6 sq. ft. Pack. and Post., 1/ sq. ft.

SARLON PLASTIC CLOTH Ideal for coveri Speaker Cabinets, etc. 8/9 sq. ft. Pack. and Post, 6d sq. Call or write for samples of stock patterns.

ELECTRO-DYNAMIC SPEAKERS
12in 1500 ohm field. Brand new. 39/6. Pack. and Post.

GOODMAN'S 12" WOOFERS
Brand new but shopsoiled.

Audiom 60	£21/19/6.	Freight
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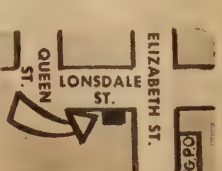

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TRADE ALS SUPPLIED

Please add postage or freight to all orders.

ON · SHORTWAVE
BY ART CUSHEN

(Continued from Page 99)

5 metre band, which have replaced he 11903 Kc channel.

Broadcasts are on 11917 and 11897 Kc. The station has been heard at 7 a.m. nd on Sundays at 8 a.m.

ALGIERS has been reported with tests n several projected frequencies, but has ow returned to its former assigned requencies. The French program of Radio Algiers is on 11835 Kc, and is eard from 3.30 to 6 p.m., 8 p.m. to a.m.

ELGRADE with transmissions from he Yugoslav capital has a session in English, 12.45 to 1 a.m. and 1.45 to a.m., and on 11735 and 15245 Kc. The station has Arabic from 2.30 to a.m. on 6100 and 9505 Kc.

AGHDAD which uses 6030 Kc has een suffering from interference from tuttgart on the same frequency. The ation has been heard with German at a.m. and a session in English at 30 a.m.

News from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Eastern Australian.

NITED STATES station KGEI, which as broadcasts each day exclusive for atin American listeners in Spanish, ortuguese and English on 17795 Kc is ow on its new schedule. The station is n the air from 9 a.m. to 1.10 p.m. n Mondays the station closes at 1 p.m.

AITIAN station 4VWI has appeared n 9770 Kc and has been heard in orth America at 12.50 p.m., and the nouncement indicated that only one equency was in use. The reason was ving to trouble with equipment, which at the moment being transferred to new location. Our information from e "Standard," the publication of the riental Mission Society, which operates VEH, 4VWI and 4VC is that a trans-itting site is soon to be used, trans-itter buildings are now completed, and e station is at the moment in process moving to its new broadcasting home, hich will ultimately enable a better gnal to be transmitted.

RENCH CAMEROON station Radio aroua is now broadcasting 9.15 to 11 n. and 3.30 to 7 a.m. The station gn-off on Sundays is at 7.30 am., and s also applies to the Monday morning nsmission. The station uses 7240 Kc th 40,000 watts and, after 3 a.m. is ng 5010 Kc with 40,000 watts. News French is broadcast at 9.30 a.m., 4.30 n. and 6.30 a.m. The station address Post Office Box 103, Garoua.

ORY COAST station Radio Abadjan now operating 4.30 to 6 p.m., 10.15 11.30 p.m. and 3.45 to 8.30 a.m. The tion on Sunday extends the broadcast 10 a.m. Broadcasts are on 4940 Kc h 10,000 watts for the first and last nsmission, while other broadcast is re-sed on 7125 Kc, 25 Kw. News in nch is at 4.45 p.m., 10.45 p.m., 4 ., 6 a.m. and 8.30 a.m.

ONTEVIDEO station Radio Monte rlo, uses 6140 Kc from 8 p.m. to .m., with the call CXA20 with 2,500 tts. The station is on 9595 Kc CXA-with 10 Kw for the period midnight 5 a.m. Radio Sarandi is using a schedule of 10 p.m. to 8 a.m. on CXA71 9515 Kc with 10 Kw, and 10 a.m. to noon on CXA60 on 15385 Kc with 20 Kw. A further transmission noon to 2 p.m. is on CXA68 on 11885 Kc with 25 Kw. Radio El Expectador, also in Montevideo, operates on a new outlet, using CXA61 on 60-45 Kc, power of 10 Kw from 10 p.m. to 1 p.m.

SWITZERLAND is now broadcasting its regular weekly DX Program over several transmissions and our best reception is at 5.50 p.m. on Friday on 11865 Kc. The complete times of the release of this program are 5.50, 7.35, 11.20 p.m. on Friday and 1.20, 3.20, 5.20 a.m., 12.05 and 2.50 p.m. on Saturday.

SEYCHELLES Radio, which transmits from Victoria, has been heard on 4990 Kc by Asian listeners. The station is tuned from 2 a.m. to 2.18 a.m. after a news relay, side interference from Hyderabad on 4988 Kc.

TASHKENT in the Soviet area of Central Asia is broadcasting in English twice daily, from 10.30 to 11 p.m. and 2.30 a.m. to 3 a.m. The frequencies of 11690 and 7100 Kc are employed. The program is mainly on life in Central Asia, and features a stamp collector session every second Wednesday. On Saturday the station features a mailbag session during which letters from listeners are answered.

MONTHLY NEWSLETTER

We would like to apologise to our regular readers for the lapse of this Newsletter over the last two months, but owing to the fact that the Writer, Editor, Designer and Manager were all overseas. (No! They are all one man), no one else in the Firm would take it on.

However, I have now returned and would like to start off the new series with some observations and news from around the world, from Hong Kong, where as a free port you see a fluid collection of items from every country at prices we find hard to believe, to Italy, where the emphasis is on glamour rather than good sound in audio equipment, but whose laboratory equipment is of fantastic accuracy; Germany, where we have obtained further agencies for many exciting new lines; Iceland, where the only Hi-Fi gear is four years old and America, where they make things in millions and hope the blazes they will sell in the same quantity. A great amount of their equipment is built with a vast complexity of knobs, buttons, levers and coloured lights and nothing inside worth mentioning, although the instrumentation and lab. equipment and the very high quality audio gear is excellent and we have been fortunate to secure Australian agencies for many of the top lines.

Many of the hotels in Hong Kong are equipped with Stereo, the usual system being a large power amplifier located in the office, the source of program material 15in pre-recorded tape spools, feeding to speakers in the lounges, private bars and reading rooms and I noticed that most installations were using Wharfedale Columns or ceiling corner fittings. Two major hotels were using a system which has evidently been especially designed for them. Taking pre-recorded four track tapes, the four tracks all running in the one direction, two of the tracks carry modern mood or dance music and the other two classical music, thus giving two programs to be piped into separate amplifiers and fed to the respective rooms requiring atmosphere.

Private radio telephone is most popular in Hong Kong as in the U.S.A., the non-licence Citizens' Band which has been allocated for private use becoming almost jammed. I actually saw a Rickshaw with a small Citizens' Band communication receiver tied to the side!

Hi-Fi Showrooms as we know them are very much in evidence in the tourist shopping centres of Hong Kong, but get away from these and it is not uncommon to find the best English gear in a general merchants, with a Leak reposing on a shelf beside skeins of wool and the most peculiar looking foodstuffs, and a Quad Preamplifier hanging by its connecting leads in company with sides of bacon. Of course one's feelings can only be imagined to see our prized items of equipment ranged in retail stores by the dozen at prices one-third less than our trade costs. It takes considerable self-control to keep from spending the entire official allowance. It was only the thought of the coming world trip without finance that kept my traveller's cheques intact.

Now to the newsy side. Recently arrived in our Showroom is a very fine line of stereo amplifiers, some of which combine AM and FM tuners in outputs ranging from five to twenty watts per channel. Their performance is quite outstanding and the fantastic array of control positions gives a flexibility which is seldom found in medium price range equipment. They range from approximately £87 to £160 and we feel that they are very competitively marked. They are also rather stunning in appearance and finish. The mechanical and technical quality is beyond reproach.

By the way, the new Boeing 707s, along with most other long range aircraft of today, are also using pre-recorded tape musical programs whilst in flight. Unfortunately each airline seems to specialise in one recording. I heard "Charmaine" about five times on the Hong Kong-Rome trip and again a week later on the same airline.

Until next month then, when I hope to concentrate on the technical aspects of interest in the German field, we remain.

Yours,

VICTORIAN TELE-SERVICE PTY. LTD.

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TRANSISTOR PRE-AMPLIFIERS or LINE TRANSFORMERS

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IMPROVED TYPE

- *Size 2 1/8" x 2 5/8" x 3 3/16".*
- *Finish: Grey hammertone.*
- *Enables the use of Dynamic or Velocity Microphones with tape recorders and on low gain amplifiers.*
- *Switch jack provides input connector, with the use of a type 150 plug which switches the battery on.*

TYPE 213
50 ohms input to Grid or High Impedance output.
TYPE 214
Grid input ohms to Grid or High Impedance output.

- *Provides greater sensitivity without tonal loss or distortion.*
- *Both types have an approx. gain of 12db.*
- *Model 213 is ideal for use additionally as a line transformer for low impedance microphones to grid impedance.*
- *Long Life Operation. on "flash torch" 4.5V battery.*

Supplied complete as illustrated and fitted with one 3703 4.5 volt battery. Price including Sales Tax, £7/1/9.

Manufactured by

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all transistor circuit

plays or records 50 hours on 4 torch batteries

48 gns.

(includes tapes and microphone)

completely independent of power supply

This wonderful little machine (size 9½" x 5" x 3⅝", weight 5 lbs.) records anything, anywhere. New patented governor controls tape speed to an accurate 3¾" per second — your tapes will play back faithfully on larger machines. Twin track recording gives nearly an hour's play from one tape. Record from microphone, radio, telephone, or use Transitape as a straight-through amplifier or telephone amplifier — with or without recording.

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CHILDREN'S VOICES
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BEATS ALL OTHERS FOR VERSATILITY, PORTABILITY AND PRICE!

CLARION transitape

Distributed by **BROWN & WATSON ELECTRONICS PTY. LTD.,** 281 Latrobe St., Melbourne. MU 3286

REMOTE CONTROL FOR TV SETS

(Continued from Page 43)

ect this to the active side of the voice oil, making available a low impedance ignal source at the control unit. A uitable single circuit jack and phone lug, preferably a miniature type, proides a convenient means of connection.

Almost any type of magnetic earhone will operate satisfactorily from his source, either the high impedance 2,000 to 4,000 ohms) or the low imedance (100 to 200 ohms) disposal ypes, both giving very much the same coustic output. As a general rule a olume setting which is adequate for peaker operation may be a little too igh for the phones.

CRYSTAL TYPES

Miniature crystal types, such as used ith personal transistor sets, are likely be attractive in this application, due their small size, light weight, and bsence of any need for a headband. owever, due to their capacitive nature ey will suffer from a constantly rising esponse curve when operated from a w impedance source. A series resistor about .22M connected in series will rrect this condition, although the act value may have to be found by periment.

While using an earphone it will be ecessary to silence the main speaker. An sy way to do this is to fit a small two sition switch on the rear of the binet, being arranged to open the eaker voice coil and substitute a nilar value resistor, usually about 3 ms.

The next logical step is to provide outlet for a hearing aid earpiece to used simultaneously with the speaker someone who is hard of hearing. earing aid firms are already providing ch facilities, either in conjunction with rtain TV manufacturers or on an inpendent basis, and the idea is underndably popular with those who need

Typical hearing aid earpieces at esent in use are 50-ohm magnetic es, and these give very satisfactory ults when operated from the conven- nal 3.5 ohm voice coil. While much pends on the order of hearing loss the level which other viewers might fer, it does appear that, in general, re is enough level here to cope with st situations.

GHER OUTPUT

n special cases where a higher out- is required, there are a number of proaches. A speaker transformer ing both 3.5 and 15 ohm secondaries ght be used, the lower one for the aker and the higher one for the hear- aid, and this should provide all the el likely to be needed.

Alternatively, a simple auto transmer may be used to produce the same ct. Descriptions of such a unit were en in the September, 1952, issue, and quite simple to make.

Another approach is to use a 15 ohm aker and transformer from the start, ming a set under construction and possible need for hearing aid facilities. Since inexpensive 15 ohm speakers and transformers are now readily available, they can be fitted just as easily as the more conventional types.

It is virtually essential to have a separate volume control in the hearing aid circuit, since it is most unlikely that the volume and dynamic range normally present at the speaker will match the requirements at the earpiece.

A 50 ohm wire wound pot will satisfy this requirement, being connected directly across the voice coil circuit, with the signal for the earpiece being tapped off by the moving arm. The alternative layout we have shown makes provision for another control, which may be either this or a contrast control if one is practicable. In the event that both are likely to be required a further variation of the layout may be necessary.

There is ample room in the case for a muting switch and up to four miniature controls (1in diameter approx.). However, the hearing aid control will need to be a wire wound type, normally available only in the larger (1¼in diameter) style, and this may call for some juggling of the positions to make the best use of the available space.

Alternatively, there may be some advantage in separating the hearing aid control from the main unit, to allow the user more convenient and comfortable access to it. This is purely a matter of personal choice.

The user of a hearing aid may elect to use his existing earpiece, or purchase a second one purely for TV listening. These devices are not cheap, but there are some advantages in a second unit. Hearing aid manufacturers point out that the continual plugging and un-plugging of the earpiece will most probably result in excessive wear and consequent service problems.

INCONVENIENT

In addition, the user is deprived of the immediate use of his hearing aid while using the earpiece for TV. This may be inconvenient or embarrassing if he wishes to join in conversation during breaks in the program. With two earpieces it may be possible to use one in each ear, the regular hearing aid simply being switched off or turned down until required.

In any case, it is necessary to provide a suitable miniature two pin socket on the unit to suit the hearing aid fitting. It may be possible to purchase such a socket from the hearing aid company concerned but, as an alternative, many of these plugs will fit the spacing of miniature 7 or 9 pin valve sockets.

It should not be beyond the ingenuity of most readers to fit one of these to the unit, preferably behind a small hole just large enough to take the miniature plug. The punched bakelite style of socket appears to be the most suitable for this application.

The foregoing cover most likely requirements, except a contrast control. As we said earlier, this presents some special problems. We are working on a circuit at the moment which shows promise, but a complete assessment of its capabilities will take more time than we have available right now. For this reason it will have to stand over, but we hope we may be able to tell you more about it next month.

PUBLIC NOTICE

APOLOGY: Mastersound Sales, 400 Kent Street, Sydney, wish to apologise to the many readers who called to see our Hi-Fi shop before the completion of building alterations. The delay was due to council restrictions. We are now definitely open and are giving daily demonstrations on the world's best Hi-Fi and Stereo sound equipment on our "COMPARATOR." Hear Australia's only "WALL OF SOUND," a unique multi-speaker Hi-Fi dream. (See page 90). You are welcome at all times. MASTERSOUND, 400 Kent Street, Sydney, BX2977. After hours FU9197 (J. Myer).

JABEL

Parts Kit for the Hobbies TV REMOTE CONTROL UNIT

Comprising: Ivory cabinet with back, and rubber feet, Brightness and Volume potentiometers, with knobs, muting switch, 25ft 5-core plastic-coated cable, miniature jack and plug, transfers, grommet, etc. **50/-** plus Sales Tax.

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Remarkable Cathode Advance . . . . .

N 132 cathode base material, produced by a vacuum-melting process . . . is a new and extraordinary base composition for cathodes. N 132 makes possible substantial improvements in cathode uniformity, contributing significantly to the reliability and performance of Radio and TV valves.

Vacuum-melting reduces the level of contaminants such as copper and sulphur. It also permits rigid controls to be placed on the presence of essential elements such as carbon, manganese, silicon, magnesium and titanium. As a result, this process yields exceptional uniformity from one melt to another, therefore holding cathode characteristics within strict limits. In addition, the process reduces the deoxidizing agents usually employed in processing nickel batches. This minimizes the possibility of gaseous contamination as the cathode material heats and ages, assuring long-term, reliable performance in high impedance circuits.

AWV valves utilizing N 132 cathode material can add a greater element of reliability to your circuits. Ask your AWV Representative — he'll be glad to prove the point.

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ANSWERS TO CORRESPONDENTS

F.B. (Fort Valley, Q.) wants to convert a battery set to a mains operated version and wants to know if we can supply a circuit.

A. There are a number of problems associated with such a changeover, particularly regarding the suitability of the existing coils for use with the new valves. The best we could do would be to provide a typical A.C. circuit to serve as a guide. This would be available through the postal query service.

R.J. (Ararat, Vic.) lives in a TV fringe area and wants us to find some method of increasing signal strength and reducing noise under such conditions.

A. We would like to help, R.J., not only for your sake but for ours, too. If we could do as you say we probably would make a fortune. Apart from a few standard techniques, such as using the best possible aerial, and possibly a mast-head preamplifier, there is little that can be done to help. We gather that you already have done the best possible with the aerial, so you may simply have to take the signals as they come.

J.S. (Leongatha, Vic.) is one of our younger readers who has a number of questions concerning some projects he has in mind.

A. The type 89 valve is a triple grid power amplifier. It may be used as an output triode, an output pentode, or a driver triode for a class B stage. As an output pentode it may be used with up to 250 volts on plate and screen, minus 25 volts on the grid, and requires a 7,000-ohm load. It will deliver 3.4 watts. For further details refer to R.C.A. Receiving Tube Manual. The crystal earpiece may be used, but it must not be allowed to pass any D.C. The high impedance makes it difficult to use correctly without a special output transformer. However, it would be worth trying across the secondary of the specified transformer. Many thanks for your report on the crystal set, and we are glad to learn that it works so well. There is not much we can do to help regarding the receiver fault, but suggest you check the operating conditions of the output valve and the coupling capacitor in the grid circuit. Even a small leakage here can cause serious distortion.

B.K.S. (West Kempsey, N.S.W.) has built the All Band Three and fitted a commercial broadcast Reinartz coil. He is troubled by two local stations which prevent reception of distant stations.

A. Your problem is not unusual, and it is probable that you are expecting rather too much for a simple set. However, it may be possible to improve matters by careful selection of the aerial length and use of the aerial tappings provided on the coil. A smaller aerial will reduce sensitivity, but it may still be possible to find a compromise which will reduce the local signals while still permitting reception of more-distant ones. Alternatively, a wave-trap might help. The "Handie Talkie" should not consume any more current than any other similar set, and it would be a good idea to check the H.T. current in case the bias circuit is at fault.

N.B. (Hawthorn, Vic.) is interested in the transistor amplifier described on page 58 of the August, 1959, issue. He wants to know if this can be used as an amplifier for a crystal set or pickup.

A. No, N.B., this circuit was carefully designed for a special job. We have described a crystal set amplifier and we could let you have this through our postal query service if you require it. An amplifier for record playing is rather more complex, but we have published circuits suitable for this job.

W.A.K. (Yannathan, Vic.) is trying to use an A.C. set from a six-volt battery and a genemotor, but is having trouble with interference.

A. The last filter capacitor should be retained at least, and the complete filter system with choke and first electrolytic may be necessary in some cases. Each brush should be bypassed with a small value of capacitance, say about .01 mfd. We cannot follow your reference to connections being removed from the power valve, since this must be left exactly as before if the set is to perform correctly. Possibly you mean the rectifier. Failure to get good results from a car aerial probably is due to an unsuitable aerial coil. This should be specially designed for this type of aerial. In any case, this section almost certainly will need some alignment when used in this way.

N.S. (Toowoomba, Q.) has built the All Band Three and wants to know if it can be used from a 240-volt A.C. inverter rated at 30 watts.

A. There should be plenty of power available for this little set, N.S., and the only query might be the frequency of the supply. This may be 100 cps instead of 50 cps and, while not normally significant, may upset the operation of the transformer in some cases. However, provided there is no obvious sign of trouble, we suggest you go ahead with the idea.

J. B. (Ardmore) wants to combine an overseas Control Unit design having a nominal output of 4 volts with a Playmaster Amplifier, requiring a nominal input for full output of about 0.25 volt.

A. The two may work together reasonably well, despite the difference in the figures. The overall gain would be high and, depending on the input source, you may find that the normal working range of the volume control potentiometer is concentrated near the minimum or "off" position. You could lower the gain of the basic Playmaster by using a 12AU7 phase inverter in place of the 12AX7, changing the bias resistor to suit and lowering the feedback resistor to obtain the same order of gain reduction. The actual values you would have to work out for yourself.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out in detail below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily, if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we, as a matter of policy, debate the relative merits of competitive products. Prices, details and specifications of merchandise must be obtained direct from our advertisers.

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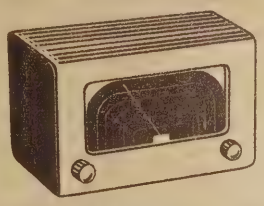

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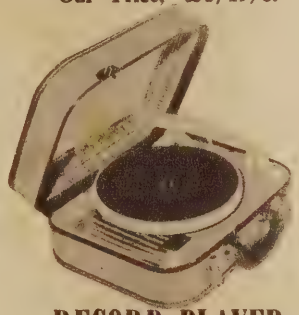
Our Price, £5/19/6.



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A really excellent job with English 4-Speed Record player and 2 sapphire styli automatic stop and start. Worth 29 gns. Our price only 19 gns.

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★ SPECIALS ★

5. **Germanium Diodes.** English make. Brand new and perfect. Ideal for use in crystal sets, for radio detectors, rectifiers etc. **Price only 3/11 each.**

6. **Transistors** are available as follows:

OC44	38/	TS3	28/9
OC45	36/7	2N185	31/6
OC71	27/	2N250	58/3
OC72	66/6 pr	2N252	37/6
TS1	24/3	2N308	35/6
TS2	27/9	2N309	37/6

7. **SPEAKER WINDINGS.** A large variety of these are available to suit all popular makes of speakers. When ordering let us know size and make of speaker and primary impedance of old transformer. **Price only 1/11 each.**

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12. **2 Gang Small AWA Condensers,** as above. **Only 13/9 each.**

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14. **Aluminium Chassis.** Undrilled. Available as follows:

5 x 3 x 2 . 6/9	13 x 7 x 2½ 14/
6 x 5 x 2 . 7/6	13 x 10 x 2½ 17/6
8 x 5 x 2½ 10/	17 x 8 x 3 . 22/6
10 x 6 x 2½ 12/	17 x 10 x 3 . 25/6
11 x 8 x 2½ 14/	17 x 12 x 3 . 26/6

15. **250 ohm 25 Watt Rheostats.** A very robust job with mica and porcelain insulation. **Price only 4/6 each.**

16. **150mA Power Chokes.** 200 ohms, D.C. resistance. A very good heavy duty choke for amplifiers, etc. **25/ each.**

17. **12/50 Chokes. Price only 5/ each.**

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19. **Coil Winding Wires.** Wind your own coils for crystal, valve and transistor sets. Below are listed popular wires and prices per yard and per ¼lb reel.

Gauge B. and S.	S.W.G.	Enamelled per yd.	per ¼lb reel
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16	18	4d	—
18	19	4d	7/6
20	21	4d	8/
22	23	3d	8/3
24	25	2d	8/9
26	27	2d	9/4
27	29	2d	—
28	30	1d	10/9
29	31	1d	—
30	33	1d	11/3
33	37	1d	14/6

20. **Bakelite formers** can be supplied cut to length as required.

Diameter	Price per inch
¾-inch	5d
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1¼-inch	6d
1½-inch	6d
2-inch	8d
2½-inch	9d
3-inch	10d

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ANSWERS TO CORRESPONDENTS

(Continued from Page 107)

A. M. (Meningla) wants to know if a C type speaker could be used for the our Transistor Superhet of May, 1959. le also suggests that we describe a mid-et pocket type receiver.

A. As pointed out in the article, the ower output from this set is quite mited, and an efficient speaker is nec-ssary for good results. We think you ould find this speaker too small and esults might be disappointing but, since ou have it on hand, there would be o harm in trying it. We would like describe a pocket type set as you ggest, but this is quite impossible un-l suitable parts are available on the cal market.

S.G.B. (Melbourne, Vic.) is seeking rther information on the construction f door chimes and wishes to know the ate we published this information and hether copies are available.

A.: The constructional article on an ectric door chime was featured in our ctober, 1948, issue. We regret that we re unable to supply either the issues r the reprints of the article as these ave long been exhausted. Nevertheless, should be possible for you to obtain e information from other sources. Ads. or back copies frequently appear on e classified ads. page of this journal nd we suggest contact of one of these s a possible source. At the worst, it ould be possible to obtain photostats f articles from your public library at very nominal cost.

S.M. (Redcliffe, Q.) is interested in e V.T.V.M. of January, 1959, and ants to know it it would be possible avoid having one side of the input rcuit earthed.

A.: We doubt if the scheme would be asible, S.M., at least not without com-ication due to the possible injection of m. The earthed input lead is a norm-ly accepted characteristic of the .T.V.M. in general. Resistance meas-rement normally is not difficult, remem-ering that it frequently is necessary to ft one side of the resistor from the rcuit, anyway. Voltages above earth sually can be calculated by measuring oth points to chassis and calculating the fference. Many thanks for your kind marks about the magazine.

R. McH. (Sydney, N.S.W.) is one of ur younger readers who is keen to get s Amateur licence and wants to know the No. 19 disposals unit could form e basis of an amateur station. He also omments on his experiences with a dis-osals CRO tube.

A. We have not had a great deal of pportunity to experiment with the arious disposal units, but our impres-on is that very few of them are suit-ble for this work, without a lot of teration. We feel that it would be tter to start from scratch than to try make shift with such equipment, par-cularly for a beginnner. The pattern ou describe on the CRO tube would most certainly appear to be a hum pat-rn, due to an external magnetic field. his may be checked by temporarily oving the tube away from the power ansformers. It must be realised that agnetic fields cannot be shielded in the me way as electrostatic fields, requir-g quite substantial masses of iron or eel to do a complete job.

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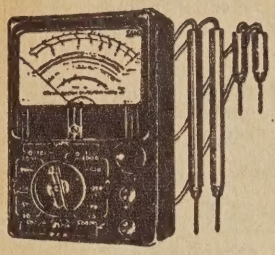

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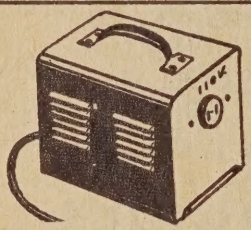
Decibels: 40db to 122db; 120db to 136db.
Resistance: 0-10K; 0-1 Meg.
Capacitance 0-03 mfd on 250 volts A.C.
0-5 mfd on 10 volts AC.
Special resistance range 0-100 Meg on 250 volts DC
Complete with batteries and test leads.

Price £7/10/. Post 8/6.

The Deluxe "305G"

High sensitivity 40 micro amps full scale meter measurers AC volts 0-10v, 50v, 250v, 500v, 1000v (8000 ohms/V) DC volts 0-10v-50, 250v, 500v, 1000v, (20.000 ohms/V) DC current 0-50 micro amps, 2.5mA, 25mA, 250mA. Resistance 0-5k, 50k, 500k, 5 Meg. Decibels Obd-22db (AC 10v range). Odb to 0.755v-600 ohms. Special range for DC 5,000 volts. Complete with batteries and test leads.

Price £15/15/-. Post 8/6.



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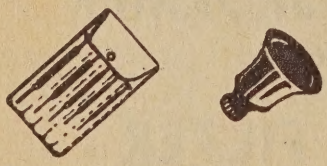

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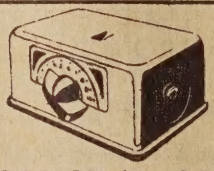

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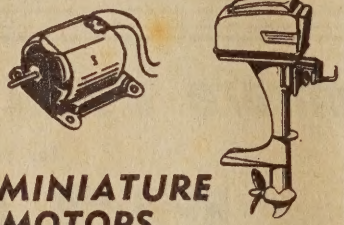
Price 39/6. Post 3/6.



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The perfect unit to power your models, operating from ordinary batteries.

MOTORS
Model 45, 8/6. Model 55, 10/6.
OUTBOARD
Standard, 4½in, 15/; Deluxe, 5½in, 29/6.

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8-DAY CAR CLOCKS

Both clocks have 8 days jewelled movements, and were originally made for aircraft use. They make ideal car clocks. The Elgin, with recessing base £7/10/, the Smith with flat base £3/10/.

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Command Modulators

Price 25/.

HEADPHONES

High impedance S.T.C. headphones.

Price 27/6. Post 3/6

RADIO CHASSIS TO CLEAR

Chassis with £2-£3 worth of parts given away for as little as 10/. Personal shopping only.

SCR536 Handie Talkie Crystals and Coils Transceivers

Matched sets of crystals and coils available at 50/ per set. Frequencies: 4397.5, 4495, 5327.5, 5397.5, 5780, 5920. Single crystals available at 47/6. Frequency, 5500 KC (5.5Mc).

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NEW VOLT and AMP METERS

0-15 Volt AC/DC 3⅛in diam.	55/
0-50 Volt AC/DC 3⅛in diam.	55/
0-250 Volt AC/DC 3⅛in diam.	70/
0-1 Amp AC/DC 3⅛in diam.	55/
0-3 Amp AC/DC 3⅛in diam.	55/
0-5 Amp AC/DC 3⅛in diam.	55/
0-20 Amp AC/DC 3⅛in diam.	55/
0-30 Amp DC 3⅛in diam.	55/
0-50 Amp AC/DC 3⅜ diam.	55/
0-50 Amp DC 3⅛in diam.	55/
0-100 Amp AC/DC 3⅛in diam.	55/
0-1 Milliamp 1⅛in square	37/6
0-100 Milliamp 1⅞ square	50/
0-50 Microamp 1⅞in square	70/
0-100 Microamp 1⅛in square	50/

Postage 6/.

Bargain Priced Valves

1D5	10/6	6L7	12/6	12J5	10/6
1P5	1/6	6N7	9/6	12SH7	10/6
1T4	4/6	6R7	12/6	12SK7	10/6
6A8	10/6	6SC7	12/6	12SR7	4/6
6AB7	10/6	6SF5	7/6	71A	10/6
6AG5	6/9	6SH7	2/3	217C	10/
6AJ5	9/6	6SJ7	12/6	830B	10/
6C4	5/	6U7	4/9	954	1/6
6C8	7/6	6X5	9/6	958A	1/11
6G6	12/6	7A6	5/	7193	1/6
6J5	12/6	7A8	5/	9006	7/6
6J7	4/9	7C5	5/	AV11	1/11
6K7	3/11	12A6	7/11	EF50	1/6
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METROPOLITAN RADIO SUPPLIES

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TRANSISTORISED TWO-UNIT INTERCOM

(Continued from Page 33)

eads up out of the way. (Do not short nem). In fact, a variety of inductances an be used here provided the resistance not too high.

The switching itself is fairly straight orward. Both base station and remote witch are spring loaded into the "listen" osition. The base uses a two-position ree-pole and the remote a two-posi-on one-pole. The remote speaker is onnected normally to the amplifier in-ut via the base switch and is trans-rred to the output by pressing the ase switch-to-talk. This also changes ver the base speaker to the input from ne normal output position.

The third pole on the base switch rns on the amplifier at the same time, that the operator at the base end can irect his voice into the distant speaker.

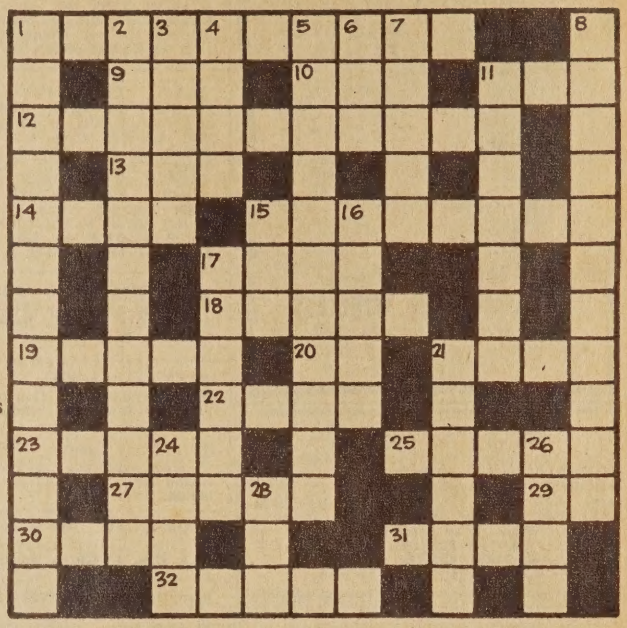
On releasing the switch, the speaker the base end reverts to the amplifier tput, while the distant speaker be-omes the microphone. However, noth-g operates till the person at the remote nd depresses his switch, to turn on the mplifier. Thus complete secrecy is pre-rved and neither operator can listen on the other without his knowledge.

If it is desired to operate the inter-om from the base end only, to use it or a baby monitor for instance, the ird wire carrying the battery positive the remote unit can be left out and e choke for that matter also. Just con-ect the battery negative to the negative g on the board.

It will also be necessary to provide separate switch to turn the amplifier n and off independently of the press-talk, either in parallel with Slc or in ace of it.

You then switch on and monitor unior's" activities for as long as you e and quite economically at that.

THE R., TV & H. CROSSWORD No. 69



ACROSS

1. Type of tuning.
9. Grain.
10. Paddle.
11. Vehicle.
12. Not susceptible to chemical change.
13. Hotel.
14. A long time.
15. Frequencies suffering least attenuation.
17. For dressing wounds
18. Finshed.
19. Needs scratching.
20. Prefix.
21. Search.
22. Closes an opening.
23. Applied to power amplifier grid.
25. Sequence of waves.
27. To be obtained for money.
29. Large island (init.).
30. Not ever.
31. Required to raise temperature.
32. Pleasure craft.

DOWN

1. Multi layer coil.
2. Not possessing self or mutual inductance.
3. Mends.
4. Type of gun.
5. A modern music form.
6. To take nourishment.
7. Sign of the Zodiac.
8. Said of a non-selective receiver.
11. Pertinent to pottery.
15. In valve base.
16. Direct.
17. Jar used in early form of capacitor.
21. Method of circuit connection.
24. In a high degree.
26. Preposition.
28. Electrical discharge.

Solution and further crossword next month

CAPACITORS DRIVE WIND TUNNEL

A HUGE bank of capacitors which can discharge a current of five million mperes—enough energy to blow a third a million household fuses simultane-sly—is being built by the General lectric Company, U.S.A., to power a w wind tunnel for missile and rocket sting. The capacitors will store energy d then discharge it in a powerful elec-c spark, exploding the compressed air the tunnel and driving it through a zzle past the model to be tested.

The G-E-engineered wind tunnel will used by the Boeing Airplane Com-any to test models of missiles and ace vehicles in the hypersonic range—om 10 to 27 times the speed of sound. ated at seven million watt-seconds, the nnel will be the largest privately owned nd tunnel in the United States, and the venth in operation for Boeing. Total st of the installation will be about e million dollars.

The capacitors, heart of the electrical stem, which will drive the wind tunnel, ll take almost a minute to reach their ll charge, but only a few thousandths a second to discharge the current in a ief, super-hot arc. Before the energy is discharged, air in the test section and exhaust chamber of the tunnel will be pumped out to a high vacuum.

Because no switch has yet been conceived which could turn on a current of five million amperes, it will be ignited by an ingenious trigger arc inside the chamber. The trigger arc is produced by a pulse of current sent through a piano wire fuse. Vaporising the wire, the current creates a path of metallic ions between the two electrodes for the main arc.

The enormous, instantaneous energy of the super-hot arc will produce temperatures up to 18,000 degrees Fahrenheit—as hot as the surfaces of the sun—and pressure of 30,000 pounds per square inch. Air at such heat and pressure turns momentarily into "plasma," a state in which molecules of a gas are broken up into their constituent atoms, and the atoms themselves are electrically charged or ionised.

The pressure bursts a plastic diaphragm at the tunnel end of the chamber, sending a high-energy shock wave through the nozzle and into the test section, followed by a hypersonic (above Mach 10) flow of air. Although the arc is over in a few thousandths of a second, the hypersonic air flow continues for 1-25th of a second. This is sufficient time for the testing engineers to measure and record hundreds of data on the air flow and the model's behaviour.

(Note: An electronic photo-flash unit stores between 30 to 100 watt-seconds.)

Last month's solution

F	I	D	E	L	I	T	Y		P			
A	M	U	S	E		U		B	R	O	A	D
R	A	N	T	S		B	A	R	I	U	M	
A	G	E			S	E	L	E	C	T	O	R
D	E	S	I	G	N		L	A	E		K	
A			L	E	O			K		P		
Y	E	L	L	O	W			D	A	R	A	F
S		U		M		S	T	O	R	A	G	E
L	A	M	B	E	R	T		W	A	C	O	
A		E		T	A	Y		N		T		B
W	I	N	T	R	Y		I		T	I	M	E
	R		H	I	S	T	O	R	I	C	A	L
	A	L	E	C			N		P	E	E	L

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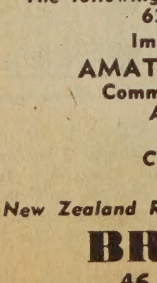

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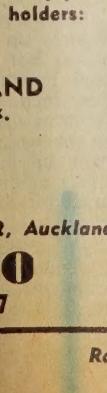

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ULTRASONIC ENERGY TO PRESERVE MILK

FRESH dairy milk from Britain in t tropics? It sounds like a fantas but it isn't. Samples of frozen m from Britain which have been sent the Middle East have been pronounc by government medical officers to indistinguishable in taste and qual from fresh pasteurised milk.

In a recent B.B.C General Overse Service broadcast, Allan Murray d cribed the new process which gives vantages over canned, sterilised milk frozen homogenised milk, in which fat tends to separate when thawed "After being pasteurised in the norm way," Murray explained, "the fresh m is treated for about five minutes w ultrasonic vibrations. Then it's pou into hygienic containers for shipme and these are heat-sealed and gradua frozen for about an hour.

"Every step in this process is carefu controlled, and the result is frozen m that retains the qualities of its liq pasteurised equivalent for anything to 18 months. In any climate its s age life is at least a year, provided kept frozen at 10 degrees Fahrenhei below.

"By the new process the fresh r returns to its natural liquid state. anything, it keeps longer than befor was frozen. Its physical properties and its taste — are unchanged. It comes, in short, what it was origin —fresh, full-cream pasteurised milk

Big orders are now being negoti and already a shipping line is using fresh-frozen milk on round voyages tween England and Australia.

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